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SECTION A OF SCIENCE ABSTRACTS

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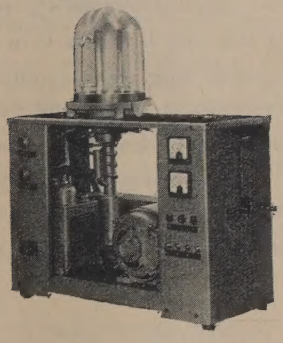

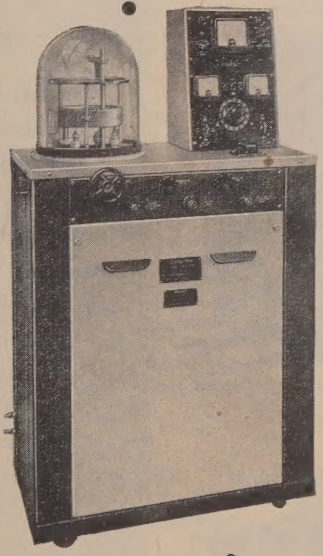

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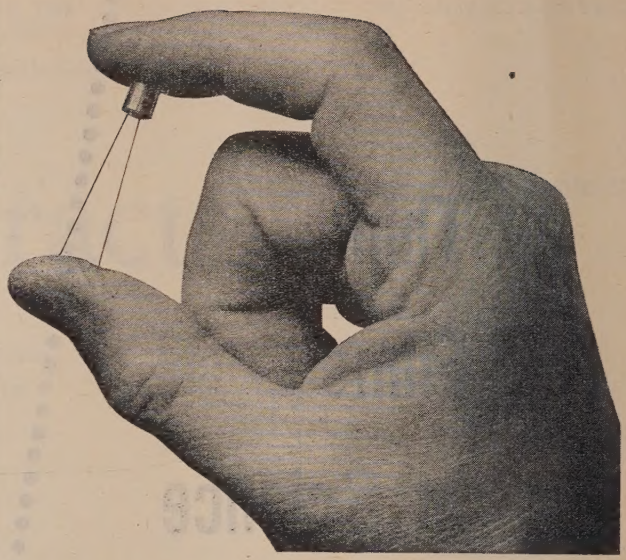

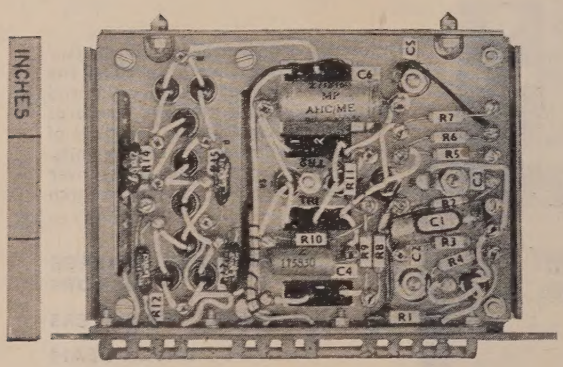

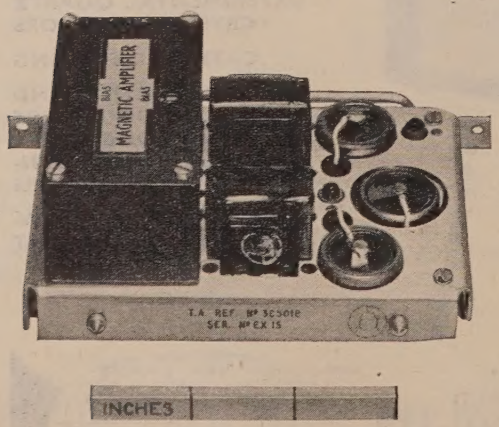

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PHYSICS ABSTRACTS

Volume 61 FEBRUARY 1958 Number 722

MATHEMATICS

517.5

478. REMARKS ON THE USE OF CHARACTERISTIC FUNCTIONS AND GENERATING FUNCTIONS IN CERTAIN PHYSICAL PROBLEMS. P.Faure and M.Savelli.
Cahiers de Phys., Vol. 11, 149-58 (April, 1957). In French.

Properties of the functions are briefly summarized. Their use is illustrated in various physical domains of study, including statistical mechanics, secondary electron emission and the granular structure of photographic emulsions. L.S.Goddard

517.566

479. AIRY FUNCTIONS. A.Rot.
Ann. Télécomm., Vol. 12, No. 10, 343-6 (Oct., 1957). In French.

It is pointed out that the equation $y'' = (ax + b)y$ is of frequent occurrence in many physical problems and it is usually solved in terms of Bessel or Hankel functions of order 1/3. Here, Airy functions, now available in tabular form, allow considerable simplification in presenting the solution. The text develops this clearly. L.S.Goddard

ASTRONOMY . ASTROPHYSICS

522.2

480. ON THE POSSIBILITY OF REDUCTION OF ATMOSPHERIC INFLUENCE ON A STAR IMAGE. V.P.Linnik.
Optika i Spektrosk., Vol. 3, No. 4, 401-2 (1957). In Russian.

The method proposes the use of a secondary mirror in the telescope. Variations caused by scintillations in the image are examined interferometrically and the wave pattern used to control movement of this mirror and thus reduce the effect. L.Bovey

523.164.32 : 525.7

481. STUDY OF THE SCINTILLATION OF THE SUN OBSERVED ON A WAVELENGTH OF 3.2 cm. I.Kazès.
C.R. Acad. Sci. (Paris), Vol. 245, No. 6, 636-9 (Aug. 5, 1957). In French.

An examination of solar scintillation on 3.2 cm shows that its characteristics vary with zenith distance of the sun. The signal changes are pseudo-periodic; the period varies linearly with $(\sec z)^{1/2}$, and the mean-square amplitude linearly with sec z. The scintillations are most prominent when there are localized regions of activity on the sun. A comparison of scintillation on 3.2 and 34 cm shows that, while no detailed correlation exists, the general characteristics and relative amplitudes are similar. These results suggest that the scintillations on 3.2 cm have an origin in the lower atmosphere. Some evidence for angular scintillation is also presented. M.W.Ovenden

523.164.32 : 525.7

482. STUDY OF THE SCINTILLATION OF THE SUN OBSERVED WITH SEVERAL AERIALS ON A WAVELENGTH OF 3.2 cm. I.Kazès and J.L.Steinberg.
C.R. Acad. Sci. (Paris), Vol. 245, No. 7, 782-5 (Aug. 12, 1957). In French.

See also preceding abstract. A comparison of the scintillation pattern with several aerials with different separations proves the atmospheric origin of the effect. The correlation decreases with increasing separation, disappearing at a distance of about 200 m. The cross-correlation coefficient varies with separation D as $e^{-(D/170)^2}$, indicating dimensions of the order of 170 km for the atmospheric irregularities. The wind velocity at the atmospheric height at which the scintillation originates can be found from the time-displacement of any two patterns that gives the maximum cross-correlation coefficient. A comparison of meteorological sonde data at a station 200 km from the observing site shows that the deduced wind velocities always have the same sense as the velocities determined by the sonde. This proves that the scintillations are truly produced in the lower atmosphere at heights comparable with the irregularities that produce optical scintillation. M.W.Ovenden

523.164.4

483. NEW OBSERVATIONS OF THE RADIATION OF THE SKY ON A WAVELENGTH OF 33 cm.
J.F.Denisse, J.Lequeux and E.Le Roux.
C.R. Acad. Sci. (Paris), Vol. 244, No. 25, 3030-3 (June 17, 1957). In French.

Isophotal charts, in units of $2.5^\circ K \pm 0.3^\circ K$, are given for the regions RA 18^h-6^h, Dec. $+40^\circ$-$+90^\circ$ and RA 4^h-8^h, Dec. $+40^\circ$--30°. In addition to a number of well recognized intense localized sources, a number of fainter sources hitherto unrecorded at such a short wavelength are noted; a table gives the flux densities of the sources. The faint sources show some correlation with positions of sources given by Brown and Hazard on 1.67 m wavelength, suggesting spectra for these sources similar to that of the Crab nebula. An asymmetrical extension of the general galactic radiation between Cassiopeia and the north celestial pole is noted, and it is pointed out that this extended source can be considered to be in a direction opposite to that of the Magellanic Clouds, as seen from the centre of the Galaxy. Outside the range of the general galactic radiation, the brightness of the sky would seem to be uniform, with a brightness temperature less than $3^\circ K$. M.W.Ovenden

523.164.42

484. 21 cm ABSORPTION EFFECTS IN THE SPECTRA OF TWO STRONG RADIO SOURCES. C.A.Muller.
Astrophys. J., Vol. 125, No. 3, 830-4 (May, 1957).

The sources observed were Cas A and Tau A. The absorption profiles were obtained by a comparison of the variation of intensity with frequency across the source with scans made at various frequencies across the source and in neighbouring regions of the sky. The resulting absorption spectrum of the Cas A source shows structure corresponding to absorption in clouds associated with the Orion and Perseus spiral arms. The line-of-sight does not meet a single detectable cloud between the arms, and the amount of dispersed gas between the arms seems to be negligible. From the absorption profile, the Cas A source can be located within, but not beyond, the Perseus arm at a distance of at least 3 kpc. A Gaussian distribution seems to be a good approximation to the velocity distribution within a cloud, but the high kinetic temperatures (270°-$810^\circ K$) corresponding to these velocity dispersions suggests that the internal motions are not primarily thermal. The absorption profile for Tau A is only preliminary, but it can be concluded that the negative velocity part of the profile comes from clouds lying behind the Crab nebula. The observed and deduced profiles are given, together with a table giving radial velocity, maximum optical depth, r.m.s. internal velocity and number of atoms per cm^2 for each cloud. M.W.Ovenden

523.164.42

485. RADIO EMISSION FROM THE REMNANTS OF THE SUPERNOVAE OF 1572 AND 1604. J.E.Baldwin and D.O.Edge. Observatory, Vol. 77, 139-43 (Aug., 1957).

Measurements of these two radio sources have been made on 1.9 m wavelength. Results of these and previous observations of positions and angular diameters are summarized, and compared with optical observations. The identification of the radio sources with the supernovae remnants is now considered fairly certain. Flux densities and apparent brightness temperatures are compared with the Crab nebula. M.W.Ovenden

523.165 : 537.591.1

486. ON THE ORIGINS OF COSMIC RAYS. P.Morrison. Rev. mod. Phys., Vol. 29, No. 2, 235-43 (April, 1957).

International Congress review paper (see Abstr. 5814/1957). The main known facts pertinent to the origin of cosmic rays are summed up. It is maintained that the origin of much of the cosmic-ray energy is nuclear in character, and the kind of model that can be built up is discussed. A stirring process would account for the isotropy of the cosmic rays; it could be caused by a chaotic magnetic field in the galaxy. A limited storage is required, and this is met by the radioastronomers' picture of the galaxy not as a flat disk but as a near-sphere. An acceleration process like the one proposed by Fermi may account for the power-law energy spectrum, and it is certain that residual magnetic fields within the solar systems play a major role in the low-energy spectrum. The absence of a high-energy cut-off is, however, hard to understand and astronomical evidence about the Virgo cluster points to the possibility of cosmic-ray energies of 10^{21} eV. Furthermore, astronomical evidence establishes the Crab nebula as a source of a synchrotron type of radiation and it seems that by this means Fermi's natural explanation of the energy spectrum is lost. •E.W.Kellermann

523.165 : 523.75

ACCELERATION OF COSMIC RAYS IN SOLAR FLARES. See Abstr. 17

523.872

487. THE CORRELATION DISCLOSED BETWEEN THE CONSTANT OF ABERRATION AND STELLAR SPECTRAL TYPE. J.F.Cox and J.Lemmens. Bull. Acad. Roy. Belgique Cl. Sci., Vol. 43, No. 5, 319-23 (1957). In French.

W.Becker (1930) first showed that values of the aberrational constant, deduced from visual measures of star positions, systematically depend on the spectral type of the field-star employed. This result was confirmed later by K.Himpel using colour-index as one parameter instead of spectral type. It appears that the effect is instrumental in origin, and most probably arises from a change in the position of max. intensity in the secondary spectrum of the telescope objective with changing spectral type of the field-star. But the possibility of a supplementary effect due to atmospheric dispersion of the starlight cannot be ignored. D.R.Barber

PHYSICS

53

488. THEORETICAL PHYSICS. G.Joos, with the collaboration of I.M.Freeman. Third edition. London: Blackie and Son (1958) xxiii + 885 pp.

This is the third edition of a well-known textbook covering the subject at the honours degree level. In this edition there are two additional chapters: one on superconductivity and the other on theory of elastomers. Sections on matrices and on lattice defects have been added.

53.084 : 621.317.7.084

489. APPLICATION OF SPRING STRIPS TO INSTRUMENT DESIGN. Notes appl. Sci. Nat. Phys. Lab., No. 15, 25 pp. (1956).

This booklet provides designers with information about some of the various applications for providing pivoting and parallel motion, conversion of linear to angular motion. The uses of buckling and twisting strips are described, and indicating mechanisms based on them. Miscellaneous uses include support of counterweights, protection of precision scales, biasing springs, and locking a carriage to a slide. Methods of attachment of spring strips are also described (22 figs., 14 refs.).

FUNDAMENTALS

530.12

490. TIME DILATATION AND DOPPLER EFFECT. J.D.Robinson and E.Feenberg. Amer. J. Phys., Vol. 25, No. 7, 490-1 (Oct., 1957).

530.12 : 538.3

ELECTROMAGNETIC INDUCTION IN A RELATIVISTIC ANISOTROPIC MEDIUM. See Abstr. 241

530.145

491. A NEW APPROACH TO TIME REFLECTION. I.Białynicki-Birula. Bull. Acad. Polon. Sci. Cl. 3, Vol. 5, No. 8, 805-7 (1957).

It is pointed out that convariance can be obtained by considering Planck's constant h as a pseudoscalar under time reflections. W.A.Hepner

530.145

492. CONFORM-INVARIANT FIELD THEORIES. R.Omnès. C.R. Acad. Sci. (Paris), Vol. 245, No. 17, 1382-4 (Oct. 21, 1957). In French.

These appear unsuited to describe the known elementary particles, for group-theoretical reasons. R.J.N.Phillips

530.145

493. NON-LOCAL SEPARABLE INTERACTION AND THE COLLISION MATRIX. M.Gourdin and A.Martin. Nuovo Cimento, Vol. 6, No. 4, 757-79 (Oct., 1957). In French.

The problem of determining a two body (e.g. nucleon—nucleon) interaction in the S state from the energy dependence of the experimental phase-shift is studied with the assumption of a non-local separable central interaction. It is shown that, under this hypothesis, the interaction is given, in momentum space, by the solution of a Fredholm inhomogeneous integral equation of second kind. General properties of this equation enable one to show that, if the physical system has no bound state there exists at most one solution; if the system has one bound state there may exist a one parameter set of solutions. Explicit solutions are obtained when the energy dependence of the phase-shift is exactly given by the shape-independent approximation. This treatment is extended to the case where $k \tan \delta$ is a rational function of the energy. In this case, existence and multiplicity of the solutions are related to the number of roots of an algebraic equation that are located in the upper complex half-plane. Further, when the phase-shift remains between 0 and π or between 0 and $-\pi$ in the whole range of variation of the energy, the results are similar to those obtained when a local interaction is assumed: if the system has no bound state, the solution is unique; if the system has one bound state there exists a one-parameter set of solutions. On the other hand, if the energy dependence of the phase-shift is no longer restricted as above, the problem can only be solved provided the values of the energy where δ goes through $n\pi$ satisfy certain inequalities. The solutions then obtained are correct in a mathematical sense, but their physical interest is questionable, because, in this case, there is no longer stability of the phase-shift with respect to small variations of the interaction. A.

530.145

494. REMARKS ON THE P.C.T. INVARIANCE OF SCHWINGER, LÜDERS AND PAULI. O.Costa de Beauregard. C.R. Acad. Sci. (Paris), Vol. 245, No. 11, 956-8 (Sept. 9, 1957). In French.

See Abstr. 7111 (1954). The theorem is expressed in a more geometrical manner, intended to clarify its essential nature. P.M.Davidson

530.145

495. A REMARK ON THE C.T.P. THEOREM. R.Jost. Helv. phys. Acta, Vol. 30, No. 5, 409-16 (1957). In German.

This paper seeks to show clearly how the theorem is related to the foundations of quantum field theory. P.M.Davidson

530.145 : 539.12

496. TWO POSSIBLE SCHEMES OF NON-CONSERVATION OF PARITY IN WEAK INTERACTIONS. B.L.Ioffe.
Zh. éksper. teor. Fiz., Vol. 32, No. 5, 1246-8 (1957). In Russian.

In one scheme invariance under charge conjugation is given up, in the other, invariance under time-reversal. (The product of charge conjugation, time-reversal and spatial reflection must always be unity). Possible angular dependences in various decays are given for each scheme. G.E.Brown

530.145 : 539.12

497. NON-CONSERVATION OF PARITY AND HYPERON DECAY. S.G.Matinyan.
Zh. eksper. teor. Fiz., Vol. 32, No. 5, 1248-9 (1957). In Russian.

Arguments similar to those of Ioffe (see preceding abstract) are illustrated by choosing a specific form for the interaction Hamiltonian and carrying through the calculation. G.E.Brown

530.145 : 517.566

498. ON THE NATURE OF FIELD FUNCTIONS.
M.M.Mirianashvili, V.V.Chavchanidze and Yu.G.Mamaladze.
Zh. éksper. teor. Fiz., Vol. 32, No. 5, 1236-7 (1957). In Russian.

It is suggested that quaternions might serve as generalized field functions. Transformations in the space of the basic vectors are essentially gauge transformations, and invariance of these can lead to conservation of various charges. G.E.Brown

530.145

499. NON LINEAR EFFECTS IN THE VACUUM POLARIZATION. II. A.Minguzzi.
Nuovo Cimento, Vol. 6, No. 3, 501-11 (Sept., 1957).

For Pt I see Abstr. 7960 (1956). The propagation of electromagnetic waves in a constant magnetic field region is studied and it is concluded that the magnetic field region properties are summarized as in anisotropic media by a "dielectric tensor", whose imaginary part is connected with the creation of electron pairs. Some analytical properties of the "dielectric tensor" as function of the constant magnetic field are investigated. A.

530.145

500. CAUCHY'S PROBLEM IN QUANTUM FIELD THEORY.
S.Kahana, J.C.Polkinghorne and J.L.Martin.
Proc. Roy. Soc. A., Vol. 241, 408-13 (Aug. 20, 1957).

Cauchy's problem is discussed and the analogue of Hadamard's result is stated for a quantized field. This is shown to hold for fields satisfying linear equations and some special results for the accessible case are obtained. In particular, a troublesome ambiguity in the classical path is noted. This has not effect on the evaluation of transition amplitudes, but it makes the evaluation of operator matrix elements ambiguous. In conclusion, the extension of the result to non-linear fields is discussed. A.

530.145

501. A VARIATIONAL METHOD IN FIELD THEORY. J.S.Bell.
Proc. Roy. Soc. A, Vol. 242, 122-8 (Oct. 15, 1957).

Skyrme's variation principle for the one-nucleon propagator (Abstr. 8487/1955) is cast into a new form which is essentially a functional Fourier transform of the original. A.

530.145 : 539.12

502. THE ANOMALOUS MOMENTS OF NUCLEONS.
J.S.Bell and T.H.R.Skyrme.
Proc. Roy. Soc. A, Vol. 242, 129-42 (Oct. 15, 1957).

The formalism of the preceding abstract is applied to calculate the magnetic moments of nucleons and the neutron–electron interaction in the symmetric PS-PS theory. Vacuum polarization is ignored, and a very simple trial function employed. With a suitable coupling constant, and a reasonable cut-off for the single logarithmically divergent integral that appears, a rather rough fit to the observed values is obtained. A.

530.145

503. A PHENOMENOLOGICAL CALCULATION OF THE EFFECT OF A NON-CONDUCTING MEDIUM IN QUANTUM ELECTRODYNAMICS. M.I.Ryazanov.
Zh. éksper. teor. Fiz., Vol. 32, No. 5, 1244-6 (1957). In Russian.

A covariant perturbation theory of the Feynman–Dyson type is constructed for phenomenological quantum electrodynamics in media. The probability of radiation by an electron is calculated in this theory. G.E.Brown

530.145

504. ON THE STRONG INTERACTIONS. J.C.Polkinghorne.
Nuovo Cimento, Vol. 6, No. 4, 864-8 (Oct., 1957).

A previous four-dimensional isotopic formalism is rediscussed in the light of suggestions by Gell-Mann and Schwinger concerning the types of strong interactions. A form for the medium-strong K-meson interactions is investigated. A.

530.145

505. FERMI INTERACTION WITH NON-CONSERVATION OF "LEPTON CHARGE" AND OF PARITY. C.P.Enz.
Nuovo Cimento, Vol. 6, No. 1, 250-4 (July, 1957).

Avoiding Pauli's canonical transformations, some direct calculations with Pauli's Hamiltonian are given which remain valid for non-zero neutrino mass. W.A.Hepner

530.145

506. A SYSTEMATIZATION OF WEAK INTERACTIONS.
N.Nakanishi.
Nuovo Cimento, Vol. 6, No. 2, 383-4 (Aug., 1957).

From the point of view of Lee and Yang, a universe is considered in which left-handed, ψ', instead of right-handed, ψ, neutrinos exist, and it is required that the weak interaction Lagrangian be invariant with respect to the transformation $\psi \rightarrow \gamma_4\psi'$. With suitable transformation properties for other quantities, it is found that for Fermi interactions the allowed coupling types are: β-decay, S, V and T; μ-capture, P and V; μ-decay, V. Other interactions are also discussed. L.Pincherle

530.145 : 539.12

507. THEORY OF THE FERMI INTERACTION.
R.P.Feynman and M.Gell-Mann.
Phys. Rev., Vol. 109, No. 1, 193-8 (Jan. 1, 1958).

The representation of Fermi particles by two-component Pauli spinors satisfying a second-order differential equation and the suggestion that in β-decay these spinors act without gradient couplings leads to an essentially unique weak four-fermion coupling. It is equivalent to equal amounts of vector and axial vector coupling with two-component neutrinos and conservation of leptons (The relative sign is not determined theoretically). It is taken to be "universal"; the lifetime of the μ agrees to within the experimental errors of 2%. The vector part of the coupling is, by analogy with electric charge, assumed to be not renormalized by virtual mesons. This requires, for example, that pions are also "charged" in the sense that there is a direct interaction in which, say, a π^0 goes to π^- and an electron goes to a neutrino. The weak decays of strange particles will result qualitatively if the universality is extended to include a coupling involving a Λ or Σ fermion. Parity is then not conserved even for those decays like $K \rightarrow 2\pi$ or 3π which involve no neutrinos. The theory is at variance with the measured angular correlation of electron and neutrino in He^6, and with the fact that fewer than 10^{-4} pion decay into electron and neutrino. A.

530.145

508. A NON-PERTURBATION METHOD FOR NON-LINEAR FIELD THEORIES. E.H.Lieb.
Proc. Roy. Soc. A, Vol. 241, 339-63 (Aug. 20, 1957).

A non-perturbation method is developed for approximating the field energy and the N-body propagators in non-linear field theories. The method is applied to the scalar meson field with the addition of $\lambda\phi^4$ to the Lagrangian. The particular problems considered (in first approximation) are: the field energy in the presence of an external source; the one- and two-meson propagators; and meson-pair theory. In all cases the answer is renormalized and the approximation is shown to give a sensible account of the specific non-linear features of the problem which come into play when either the coupling constant λ, the external source, or the particle momentum becomes large. Moreover, in the "linear" region (i.e. when the parameters are small), perturbation theory is valid and the method is shown to agree with it. However, if the renormalization is performed by the customary limiting process, the external source energy and the two-body propagator have spurious singularities which may be loosely described as "ghost states". It is not clear whether this failing is inherent in the field theory itself or in the method. Finally, a brief discussion is given of the results of the second approximation, and of the possible usefulness of the method in the more realistic pseudoscalar meson–nucleon problem. A.

530.145

509. CHARGE CONJUGATION AND ANGULAR MOMENTUM.
C.B.van Wyck.
Nuovo Cimento, Vol. 6, No. 3, 522-32 (Sept., 1957).

The formal correspondence between spin and charge as implied by the idea of isobaric spin, is explained by showing that rotations in three- and four-dimensional spaces can be expressed as generalized phase transformations. Reflections in three dimensions are also expressed as phase transformations, the eigenfunctions of which are

linearly related to those of suitable rotations. It is shown that the Kramers–Pauli charge conjugation is the charge analogue of spin in four dimensions. Hence the charge conjugation formalism presents a spin angular momentum framework which is applicable to particles with two types of spin. The four-dimensional orbital angular momentum eigenfunctions are given as a generalization of spherical harmonics. A.

530.145

510. SELECTION RULES IMPLIED BY CP INVARIANCE. G.Feinberg.
Phys. Rev., Vol. 108, No. 3, 878-81 (Nov. 1, 1957).

Some consequences of the rigorous invariance under the product of charge conjugation and reflection are discussed. The restrictions on the interactions of real boson fields with one spinor field, and of complex boson fields with charge symmetric spinor fields are derived and compared with the restrictions implied by invariance under the separate operations. Two selection rules for transitions among such boson fields are given. Some possible applications to known particles are mentioned. A.

530.145 : 539.12

511. GREEN'S FUNCTION FOR A PHOTON, ACCURATE TO e^4. S.N.Sokolov.
Zh. éksper. teor. Fiz., Vol. 32, No. 5, 1261-2 (1957). In Russian.

The sum of graphs, inclusive of fourth order, is evaluated. G.E.Brown

530.145

512. THEORY OF HIGH-ENERGY POTENTIAL SCATTERING. D.S.Saxon and L.I.Schiff.
Nuovo Cimento, Vol. 6, No. 3, 614-27 (Sept., 1957).

A new formulation for high-energy potential scattering (Abstr. 6364/1956) is extended to provide explicit formulae for the scattering theory of the three-dimensional non-separable Schrödinger equation. An integral equation is derived, for which a single iteration gives the scattering when the potential energy is not too large and is slowly-varying compared to a wavelength. The result agrees with that obtained earlier for small and for large scattering angles, but applies as well to intermediate angles and improves the earlier accuracy. Further iterations can provide greater accuracy as well as an error estimate for the first approximation. A.

530.145

513. THEORY OF SCATTERING IN THE QUANTIZED FIELD AND LOW–CHEW–WICK'S FORMALISM. T.Kanki.
Nuovo Cimento, Vol. 6, No. 3, 628-41 (Sept., 1957).

The Lippmann–Schwinger equation is studied from the view point of the quantized field theory. The general prescription for separating the "incident physical state" is given by introducing the modified contraction technique. The Low–Chew–Wick formalism is derived from the L.S. equation by virtue on the author's contraction technique which makes the former more easy to understand. A.

530.145

514. CHARGE DEPENDENT CORRECTIONS TO DISPERSION RELATIONS. II. A.Agodi and M.Cini.
Nuovo Cimento, Vol. 6, No. 3, 686-92 (Sept., 1957).

For Pt I see Abstr. 8407 (1957). The effect of the electromagnetic interactions on the dispersion relations for pion–proton scattering is investigated. The correction, which can be interpreted as a difference between the coupling constants for positive and negative mesons, attains a maximum value of the order of 5% in the energy range between 50 and 150 MeV, and is therefore by far too small to account for recent experimental indications. A.

530.145

515. DISPERSION RELATIONS FOR DIRAC POTENTIAL SCATTERING. N.N.Khuri and S.B.Treiman.
Phys. Rev., Vol. 109, No. 1, 198-208 (Jan. 1, 1958).

Dispersion relations for scattering of a Dirac particle by a potential are shown to hold for a broad class of potentials. In contrast to the field theoretic case, the derivation makes no use of the concept of causality but is instead based directly on the analytic properties of the Fredholm solution of the scattering integral equation. It is shown that the scattering amplitude, considered as a function of energy and momentum transfer, can be extended to a function analytic in the complex energy plane, for real momentum transfer. The dispersion relations then follow in the standard way from Cauchy's theorem. The final results involve one "subtraction". It is also shown that the analytic continuation into the unphysical region for nonforward scattering can be carried out by means of a partial wave expansion. A.

530.145

516. THE RANGE OF VALIDITY OF STRONG AND WEAK COUPLING APPROACHES IN FIELD THEORY. S.F.Edwards.
Proc. Roy. Soc. A, Vol. 243, No. 1235, 458-63 (1958).

The solutions of scalar meson theory with infinitely heavy nucleons are well known in the limits of weak and strong coupling, and also there is the intermediate coupling method of Tomonaga which bridges the gap between them. However, the latter requires special trial functions and a cut-off procedure, so it is interesting to try to construct a method which develops a general solution analytically, particularly in order to answer the following question: When infinite quantities are absorbed by renormalization does the weakness or strongness of the coupling depend upon the renormalized quantities only? In this paper the problem of one nucleon is tackled in the functional integration formalism. It has been shown that this method encompasses both strong and weak limits, and here an attempt is made to develop a general solution using the method of stationary phase. A.

530.145

517. REDUCTION OF THE TWO-NUCLEON PROBLEM TO THE ONE-NUCLEON ONE IN THE NONRELATIVISTIC REGION. Yu.V.Novozhilov.
Zh. éksper. teor. Fiz., Vol. 32, No. 5, 1262-4 (1957). In Russian.

Using a Chew–Low type formalism, the two-body matrix elements are expressed in terms of integrals involving one-nucleon functions. G.E.Brown

530.145

518. SIMPLE TREATMENT OF CENTRAL FORCE COLLISIONS WITH PARTICULAR REFERENCE TO PHASE SHIFT CALCULATION. S.Franchetti.
Nuovo Cimento, Vol. 6, No. 3, 601-13 (Sept., 1957).

The problem of finding the positive energy solutions of the radial Schrödinger equation for a spherical potential behaving at infinity as r^{-n}, $n \geq 2$, is considered with particular reference to asymptotic phase-shift determination. It is shown that by a proper choice of the unknown function, the Riccati equation of the problem transforms into a fairly simple 1st order equation admitting an everywhere real, finite and single-valued solution (a very simple varying one and thus particularly suited to be computed by a numerical integration) which leads directly to the asymptotic phase-shift by energy and momentum. If needed, the eigenfunction itself can be deduced, this step requiring only to perform an additional quadrature. The numerical integration is restricted to a reasonable range. This and the nature of the solution make the computational work not unduly heavy, even by hand computation. Another feature of the method is the ease with which the accuracy attained can be evaluated. A.

530.145

519. METHOD FOR SIMPLIFYING CALCULATIONS INVOLVING PRODUCTS OF OPERATORS IN MANY-PARTICLE SYSTEMS. H.J.Lipkin.
Phys. Rev., Vol. 108, No. 2, 191-2 (Oct. 15, 1957).

In calculations for quantum mechanical systems containing many particles, expressions involving matrix elements of products of operators are frequently encountered. This is of particular interest in the calculation of nuclear moments of inertia. The evaluation of such expressions by conventional methods is laborious when antisymmetric wave-functions are used. A method is proposed which greatly simplifies the calculation of these product expressions. A.

530.145

520. MATRIX ELEMENTS OF SYMMETRIC OPERATORS. G.F.Koster.
Phys. Rev., Vol. 109, No. 2, 227-31 (Jan. 15, 1958).

Discusses an extension of a familiar theorem concerning the matrix elements of vector and tensor operators between states of definite angular momentum to the case of other groups than the full rotation group and to the case of operators of other symmetries. It is found that there is an extension to this theorem but in some cases there are nontrivial complications. In addition, a method is given for reducing a reducible representation of a group which gives explicitly the matrix elements in the appropriate similarity transformation. A.

530.16 : 530.18 : 621.372.2

521. LINEAR SYSTEMS AND CAUSALITY. C.Lafleur.
Rev. H.F., Vol. 3, No. 11, 399-404 (1957). In French.

For the principle of causality see Abstr. 3011/1957. It is demonstrated that all properties of linear systems may be deduced

from three principles: those of superposition, permanence and causality. It is shown that a knowledge of the real part of the transfer function of a system is sufficient to characterize the function, and hence the system, completely. In particular, in the case of purely reactive circuits, it is necessary to take a real part formed from the superposition of purely impulsive functions. L.S.Goddard

530.162 : 530.145

522. DERIVATION OF THE ENERGY-DISTRIBUTION FORMULAS OF QUANTUM STATISTICS. R.D.Cowan.
Amer. J. Phys., Vol. 25, No. 7, 463-5 (Oct., 1957).

The energy-distribution formulae of quantum statistics are derived in a way which treats all three cases (Bose–Einstein, Fermi–Dirac, and corrected Boltzmann) in a similar manner, so that the relationship of each case to the others is clear throughout the derivation. Stirling's formula for the factorial, which is of dubious applicability in the Fermi–Dirac case, is not required. A.

530.162 : 536.21

523. ON THE STATISTICAL MECHANICS OF IRREVERSIBLE PROCESSES. I.Prigogine.
Canad. J. Phys., Vol. 34, No. 12A, 1236-45 (Dec., 1956).

"Electron transport" Conference paper (see Abstr. 8734/1957). An account of previous work (Abstr. 121/1957) with particular reference to thermal conductivity in solids. It is shown that Boltzmann's equation is not valid for large thermal gradients. D.M.Edwards

530.162

524. RELAXATION OF A SYSTEM OF PARTICLES WITH COULOMB INTERACTIONS.
W.M.MacDonald, M.N.Rosenbluth and W.Chuck.
Phys. Rev., Vol. 107, No. 2, 350-3 (July 15, 1957).

The relaxation to a Maxwellian distribution of a system of particles interacting through inverse-square-law forces is investigated in the approximation of two-particle interactions resulting in small-angle deflections of particle trajectories. The time required for the relaxation of the distribution in the neighbourhood of the average energy is found to agree with the self-collision time defined by Spitzer. The time required for the distribution to become Maxwellian throughout the range from zero energy to several times the average energy is found to be nearly ten times the self-collision time. Filling of the high-energy portion of the Maxwell distribution is also discussed. A.

530.162

525. AN APPROACH TO EQUILIBRIUM. H.L.Frisch.
Phys. Rev., Vol. 109, No. 1, 22-9 (Jan. 1, 1958).

The concept of statistical equilibrium of an isolated mechanical system chosen from a Gibbsian ensemble of such systems is modified to mean a state in which the observable local macroscopic properties such as the local density of particles, mean energy, temperature, entropy, etc., have attained their equilibrium values, i.e., the values which would be obtained from the density in phase space which corresponds to the appropriate stationary solution of Liouville's equation. The approach to equilibrium in time in this sense (i.e. for the local properties which are suitable averages over the action variables of the system) of a wide class of multiply periodic systems, etc., is demonstrated under the condition that a local property exist initially. Certain characteristics of such a weak convergence as monotonicity of approach after a sufficiently long time has passed and the asymptotic magnitudes of the local properties are investigated. The question of extension of this ergodic result to less restricted mechanical systems is discussed and the relationship to ergodic theory and coarse graining indicated. On the basis of the above result the general transport theory and the approach to spatial uniformity of a sufficiently ideal gas is investigated, by using as a model a gas of elastic hard-sphere molecules with vanishing diameter. In particular it is shown that under suitable conditions the diffusion in density satisfies Fick's laws and the conduction of heat satisfies Fourier's law, albeit with time-dependent transport coefficients. A.

530.162 : 533.7 : 537.52

526. SIMPLIFICATION OF THE EQUATIONS FOR THE DISTRIBUTION FUNCTION OF ELECTRONS IN PLASMA.
A.V.Gurevich.
Zh. éksper. teor. Fiz., Vol. 32, No. 5, 1237-8 (1957). In Russian.

Discusses a relation between temperature, the field variables and the mass of the plasma molecules (ions); the relation leads to a simplification on substitution into the Boltzmann kinetic equations of the plasma electrons. J.W.Gardner

530.19 : 531.314.3

527. COMPUTING THE HAMILTONIAN FOR CONSERVATIVE SYSTEMS. J.G.Marzolf.
Amer. J. Phys., Vol. 25, No. 8, 583-4 (Nov., 1957).

A simplified method for the computation is indicated. It is a special case of the matrix method of Frazer, Duncan and Collar. As an example the gyroscope problem is considered. L.S.Goddard

GENERAL MECHANICS. MECHANICS OF SOLIDS

531.231

528. MOMENTS OF INERTIA ABOUT SELECTED AXES OF REGULAR POLYGONS, RIGHT PYRAMIDS ON REGULAR POLYGONAL BASES, AND OF THE PLATONIC AND SOME ARCHIMEDIAN POLYHEDRA. J.Satterly.
Amer. J. Phys., Vol. 25, No. 7, 489-90 (Oct., 1957).
See Abstr. 3018 (1957).

MECHANICS OF FLUIDS

532.133

529. THE VISCOSITY OF LIQUID INDIUM AND LIQUID TIN. M.F.Culpin.
Proc. Phys. Soc. B, Vol. 70, Pt 11, 1069-78 (Nov., 1957).

Measurements were made using the oscillating sphere viscometer. A preliminary set of measurements on bromine was made. The viscosity was determined over a range of temperature in each case, and the results compared with Andrade's theory of the viscosity of liquids. A comparison is also made between the many sets of values of the viscosity of tin already published. A.

532.133

530. THE VISCOSITY OF LIQUID MAGNESIUM AND LIQUID CALCIUM. M.F.Culpin.
Proc. Phys. Soc. B, Vol. 70, Pt 11, 1079-86 (Nov., 1957).

The experimental technique used previously (see preceding abstract), was modified to enable measurements of the viscosity of liquid magnesium and calcium to be made. A.

532.14

531. PRECISE MEASUREMENTS OF THE DENSITY OF MERCURY AT 20°C. I. ABSOLUTE DISPLACEMENT METHOD.
A.H.Cook and N.W.B.Stone.
Phil. Trans. A., Vol. 250, 279-323 (Nov. 28, 1957).

The densities of four samples of mercury at 20°C were measured by finding the mass of mercury displaced by an accurately formed cube of known volume that just sinks in mercury. The cube is of tungsten carbide and was lapped to such an accurate form and good surface finish that the standard deviation of the volume of mercury displaced, as calculated from optical interference measurements of the dimensions of the cube, is 0.15 parts per million. The weight of mercury displaced had an uncertainty of 0.28 p.p.m. but the uncertainty of the density at 20°C is increased by errors of temperature measurement and the effects of residual grease films on the cube to up to 1 p.p.m. The mean density at 20°C and 1 atm pressure of four samples of mercury from different sources is 13.545 892 g/cm^3, the range of the four values being 1.1 p.p.m. The corresponding value at 0°C is 13.595 086 g/cm^3. The purification, chemical analysis and determination of the isotopic constitution of the samples are carefully discussed. A.H.Cook

532.517 : 535.557

532. FLOW BIREFRINGENCE AND STRESS. V. CORRELATION OF RECOVERABLE SHEAR STRAINS WITH OTHER RHEOLOGICAL PROPERTIES OF POLYMER SOLUTIONS.
W.Philippoff, F.H.Gaskins and J.G.Brodnyan.
J. appl. Phys., Vol. 28, No. 10, 1118-23 (Oct., 1957).

For previous parts see Abstr. 2092 (1957). The correlation of normal stress with the shear stress and flow birefringence of flowing solutions is extended to include the recoverable shear strain s which can be measured directly by a rotational viscometer in "recoil". This has been shown experimentally with solutions of a high-viscosity nitrocellulose in n-butyl acetate and a viscous polyisobutylene. These results show that the principal axes of the tensors of stress, strain, and optical anisotropy coincide, even when no constant shear modulus (shear compliance) exists. A.

532.528 : 534.321.9

533. OCCURRENCE AND DEVELOPMENT OF ULTRASONIC CAVITATION. REVIEW. N.A.Roi.
Akust. Zh., Vol. 3, No. 1, 3-18 (1957). In Russian.

A review of work of the last ten years. Topics discussed are: the theoretical strength of a liquid and theory of stable nuclei; behaviour of the latter in an acoustic field; strength of a liquid under the action of ultrasonics; cavitation noise. 22 refs., mainly to Western work. C.R.S.Manders

532.529

534. ON STEADY-STATE BUBBLES GENERATED BY TAYLOR INSTABILITY. P.R.Garabedian.
Proc. Roy. Soc. A., Vol. 241, 423-31 (Aug. 20, 1957).

A theory of the steady motion of a long bubble rising through an infinite plane vertical tube of liquid is presented. It is shown that, contrary to current belief, the flow is not uniquely determined by the width h of the tube and the acceleration of gravity g alone, but that the speed U of the bubble can also be prescribed. However, a criterion of stability singles out the unique physically significant flow of this type as the one which maximizes the velocity of the bubble. With the aid of a difference-differential equation derived from the free-boundary condition, the Froude number $U/(gh)^{1/2}$ for this latter case is estimated to exceed 0.2363, a value slightly higher than that indicated by earlier work on the problem. A.

532.59 : 532.583.4

535. SIMPLIFIED THEORY OF SHIP WAVES. H.D.Keith.
Amer. J. Phys., Vol. 25, No. 7, 466-74 (Oct., 1957).

The physical significance of group velocity is considered critically and a general and realistic definition given. This is used to develop a simple phenomenological theory of the ship-wave pattern including the prediction of phase changes at singularities, and the variation of the wave-making resistance of a ship with speed is shown to be governed in a simple way by the interference of bow and stern waves. A.

532.612.4

536. A DETERMINATION OF THE SURFACE TENSION OF LIQUID TUNGSTEN BY THE DROP-WEIGHT METHOD. A.Calverley.
Proc. Phys. Soc. B, Vol. 70, Pt 11,1040-4 (Nov., 1957).

The production of molten drops by bombarding the lower end of a vertically suspended rod with electrons enabled the drop-weight method to be applied to the measurement of the surface tension of liquid tungsten. The mean value obtained was 2300 dyn. cm^{-1} at the melting temperature of 3380°C in a vacuum of approximately 10^{-4} mb. A.

MOLECULAR THEORY OF LIQUIDS

532.73 : 530.162

537. CLUSTER INTEGRALS AND STATISTICAL MECHANICS OF SOLUTIONS. J.A.Barker.
Proc. Roy. Soc. A, Vol. 241, 547-53 (Sept. 10, 1957).

A formally convergent method for calculating the thermodynamic properties of solutions containing molecules not widely different in size and interaction energies is developed using the cluster-integral approach of the theory of imperfect gases. The potential energy of the actual solution is referred to the potential energy of a suitably chosen "reference liquid"; the correction terms which are required to give the correct energy for the solution give rise to cluster integrals which contain distribution functions of the reference liquid as factors in the integrand. Even if all the cluster integrals are neglected a useful result may be obtained. The first cluster integral, corresponding to the second virial coefficient in the theory of imperfect gases, is comparatively easy to evaluate. This approach provides a unified and formally exact basis for existing approximate theories of solutions, as well as a method for obtaining more accurate results. A.

MECHANICS OF GASES

533.5 : 531.778

538. EXPERIMENTS IN THE USE OF THERMISTORS FOR LOW PRESSURE MEASUREMENTS. M.Varićak.
Nuovo Cimento, Vol. 6, No. 3, 723-8 (Sept., 1957).

It is shown that bead thermistors can be used only in the pressure range from 1×10^{-3} mm Hg. On the other hand thermistor systems consisting of bead thermistors fixed to thin metallic foils take advantage not only of the high temperature coefficient of thermistors but also of the low radiation emissivity and head capacity of metals. These devices allow precise measurements down to 10^{-6} mm Hg. A.

533.51 : 614.898

X-RAY RADIATION HAZARD USING VACUUM DEPOSITION PLANT. See Abstr. 471

533.6.011 : 538.56

539. ON THE MOTION OF AN ELECTRICALLY CONDUCTING COMPRESSIBLE FLUID. H.Cabannes.
C.R. Acad. Sci. (Paris), Vol. 245, No. 17, 1379-82 (Oct. 21, 1957). In French.

General dynamical equations are established, and the propagation of sound and shock waves are discussed in the case of infinite conductivity. Application of the results to the problem of a stationary attached shock wave in the presence of a magnetic field is reported. R.A.Newing

533.6.07

540. LUMINESCENT GAS FLOW VISUALIZATION FOR LOW DENSITY WIND TUNNELS. W.B.Kunkel and F.C.Hurlbut.
J. appl. Phys., Vol. 28, No. 8, 827-35 (Aug., 1957).

At static pressures below a few millimetres of mercury the optical thickness of wind-tunnel gas streams becomes insufficient for conventional flow visualization techniques in aerodynamic testing. In the University of California low-density wind tunnel, where the free stream static pressure is of the order of one-tenth of one millimetre of mercury, use has been made of various gaseous afterglow phenomena in the visualization of low density flows. The present paper describes the successful application of afterglows in flows of nitrogen, air, argon, and helium. On the basis of recent tests the range of practicability of the enriched air glow technique was found to extend from Mach 2 to Mach 4. The argon and helium glows were found to be useful in the range Mach 1.3 to Mach 2. Discussion of the ranges of applicability and of other aspects of the observed glows is supported by representative glow photographs. A.

MOLECULAR THEORY OF GASES

533.7

541. EASILY REMEMBERED DERIVATION OF $PV^{\gamma} = C$ FOR THE STUDENT. I.Alexeff.
Amer. J. Phys., Vol. 25, No. 7, 488-9 (Oct., 1957).

VIBRATIONS. ACOUSTICS

534.2 : 550.34

542. THE CAUSES OF THE ABSORPTION OF ELASTIC WAVES O.Förtsch.
Ann. Geofis., Vol. 9, No. 4, 469-524 (Oct., 1956). In German.

A critical essay on previous theories of absorption based on elastic after-working, viscoelasticity, or friction proportional to velocity. The theory of Coulomb friction in rocks explains all the observed phenomena, including the apparent increase of period observable in seismograms which is a result of selective absorption. J.G.Oldroyd

534.21 : 538.56

543. ON THE INTERPRETATION OF HUYGENS' PRINCIPLE: THE CASE OF ACOUSTIC, ELASTIC AND ELECTROMAGNETIC WAVES. P.Boillet.
Cahiers de Phys., Vol. 11, 59-87 (Feb., 1957). In French.

This paper deals only with acoustic waves. It is a part of the author's dissertation presented in Paris in 1955. It is shown that the intuitive ideas in Huygens' Principle are justified by the mathematical theory. The latter, which occupies the bulk of the paper, is concerned with properties of the solutions of the equations of wave propagation. The work will be completed in subsequent papers. L.S.Goddard

534.22 : 532.7

544. PROPAGATION OF ULTRASONIC WAVES OF FINITE AMPLITUDE IN LIQUIDS.
L.K.Zarembo, V.A.Krasil'nikov and V.V.Shklovskaya-Kordi.
Akust. Zh., Vol. 3, No. 1, 29-36 (1957). In Russian.

Thermoelectric measurements were made at 1.5 Mc/s, for various liquids, of the variation of absorption with intensity. Liquids with a low absorption coefficient at low intensities (e.g. methyl and ethyl alcohols, toluene) were found to have absorptions two orders higher at 4 W/cm^2. The absorption coefficient was found to vary linearly with the amplitude of the acoustic pressure. The above results are in qualitative agreement with the approximate theory of Fox and Wallace (Abstr. 1621/1955). Under high static pressure increase of the absorption coefficient is limited by cavitation. C.R.S.Manders

534.22

545. ON THE TEMPERATURE VARIATION OF SOUND VELOCITY IN WATER. C.Sălceanu.
C.R. Acad. Sci. (Paris), Vol. 245, No. 17, 1371-4 (Oct. 21, 1957). In French.

This was determined in the range 27 to 81° C at a frequency of 1315 c/s. A velocity maximum is reported at about 62°C. H.D.Parbrook

534.22

546. ULTRASONIC VELOCITY, ABSORPTION, AND ROTATIONAL DISPERSION IN METHANE. B.T.Kelly.
J. Acoust. Soc. Amer., Vol. 29, No. 9, 1005-8 (Sept., 1957).

The velocity of sound was measured in methane at 3 Mc/s in a pressure range from 50 to 2 cm Hg. The velocity, plotted according to Kneser's formula $(V^2 - V_0^2)/(V_\infty^2 - V_0^2) = (f/f_w)^2/1 + (f/f_w)^2$, showed a point of half rise, due to the relaxation of the rotational modes, at 300 Mc/s per atm which corresponds to a relaxation time of 1.06×10^{-9} sec. The dispersion was confirmed by the measurement of absorption in the relaxation region. Measurements were made on a motor-driven, Hubbard-type acoustic interferometer in conjunction with a strip recorder. This instrumentation allowed the use of f/p ratios hitherto difficult to employ. A.

534.222.2

547. PHENOMENA ASSOCIATED WITH DETONATION IN LARGE SINGLE CRYSTALS.
T.E.Holland, A.W.Campbell and M.E.Malin.
J. appl. Phys., Vol. 28, No. 10, 1217 (Oct., 1957).

The opinion is expressed that heating of a large single crystal of explosive by a shock wave can be too low to cause stable detonation. On firing a bullet at 4000 ft/sec at samples of P.E.T.N. it was found that a 0.09 in. thick layer detonated but a single crystal had to be at least $1\frac{3}{8}$ in. thick. A plane shock-wave caused detonation of a crystal of $\frac{3}{4}$ in. side and four stages in the process were detected. It is suggested that rarefaction waves may be set up and inhibit detonation. E.R.Wooding

534.222.2

548. ACCELERATION OF DUST PARTICLES BY SHOCK WAVES.
S.A.Hoenig.
J. appl. Phys., Vol. 28, No. 10, 1218-19 (Oct., 1957).

A particle is accelerated when it encounters a shock wave. The drag force is calculated and used to determine the time in which the particle attains a certain fraction of the shock-wave velocity. Integration gives the distance travelled in this time. E.R.Wooding

534.222.2

549. SHOCK WAVES IN A LIQUID CONTAINING GAS BUBBLES. I.J.Campbell and A.S.Pitcher.
Proc. Roy. Soc. A, Vol. 243, No. 1235, 534-45 (1958).

Considerations of continuity, momentum and energy together with an equation of state are applied to the propagation of plane shock waves in a gas + liquid mixture. The shock-wave relations assume a particularly simple form when the temperature rise across a shock, which is shown to be small for a very wide range of conditions, is neglected. In particular, a simple relation emerges between the shock-propagation speed and the pressure on the high-pressure side of the shock, the density of the liquid and the relative proportions, by mass and volume, of gas and liquid in the mixture. It is shown from entropy considerations that a rarefaction wave cannot propagate itself without change of form, and it is argued that a compression wave can be expected to steepen into a shock wave. Consideration of the collision between two normal shock waves, moving in opposite directions, suggests that the strengths of the two shocks are unaltered by the interaction between them. This implies, in particular, that, when a shock impinges normally on a plane wall, the pressure ratio across the reflected shock is equal to that across the incident shock. When the mass ratio of gas to liquid in the mixture is allowed to tend to infinity, the various shock-wave relations for a mixture, derived with the temperature rise across the shock neglected, assume the same limiting form as the corresponding relations for a perfect gas when the ratio of specific heats tends to unity. The theoretical discussion has been illustrated by experiments with a small gas + liquid mixture shock tube. Samples of the records, obtained when the passage of a shock changes the amount of light transmitted through the mixture to a photoelectric cell, illustrate the steepening of a compression wave and the flattening of a rarefaction wave. Measurements confirm the theoretical relation for the propagation speed of shock waves. Reasonably good experimental confirmation is also reported of the theoretical predictions for the pressure which arises following the normal impact of a shock wave on a plane wall. A.

534.232

550. RECIPROCITY CALIBRATIONS.
E.Ackerman and W.Holak.
Amer. J. Phys., Vol. 25, No. 7, 454-60 (Oct., 1957).

The reciprocity technique is used currently for primary microphone calibrations. The theory of this technique is developed in this article in a form suitable for physics students; it can be used as the basis of advanced experiments. Two types of reciprocity are first discussed. One, the electromechanical, applied to many practical transducers. The other, the acoustic reciprocity, is shown to be a special case of Green's theorem. One application is discussed. These two type of reciprocity are combined to derive the electroacoustic reciprocity constant. Finally, a method is outlined of using the electroacoustic reciprocity constant for primary microphone calibrations using only conveniently measured quantities. A.

534.24 : 531.791.35 : 623.983 : 621.317.39

551. UNDERWATER ACOUSTIC ECHO-RANGING.
J.W.R.Griffiths and A.W.Pryor.
Electronic Radio Engr, Vol. 35, No. 1, 29-32 (Jan., 1958).

It is shown as a result of some experiments at sea that reverberation from the sea bottom resulting from an acoustic pulse transmission has a power spectrum similar to that of the pulse. Using this information, a theory has been developed to determine the effect of pulse duration and receiver bandwidth on reverberation level, peak signal/reverberation ratio. A comparison is made with the corresponding effects when the background is white noise, and it is shown that in both cases optimum results are obtained when the product of bandwidth and pulse duration is approximately unity. A.

534.24

552. THE REFLEXION OF A PULSE WITHIN A SPHERE.
H.Jeffreys and E.R.Lapwood.
Proc. Roy. Soc. A, Vol. 241, 455-79 (Sept. 10, 1957).

A pulse sets out from an interior point of a uniform compressible liquid sphere. The formal solution for the velocity at a surface point at any subsequent time is derived by operational methods. This solution, having the form of an infinite series of Legendre polynomials, with coefficients which are the ratios of Bessel functions, converges too slowly to be useful. A modification of a method of van der Pol and Bremmer is used, in which the first part of the series is transformed by Watson's device into a series of multiple contour integrals, which are evaluated at saddlepoints. The expressions thus derived are shown to correspond term by term to the pulses whose times of arrival can be calculated by geometrical ray theory. The shape of each arriving pulse, not obtainable by ray theory, is given by this method. It is shown that stationary time pulses which are extremals are related to stationary time pulses which are not extremals as Fourier integrals to the allied Fourier integrals. In particular, it is shown that the two singly-reflected pulses which travel within the shorter arc of a great circle are so related. If the initial disturbance is given by a Heaviside unit function, the minimum time pulse arrives as a unit function, but the stationary time pulse which is not extremal arrives gradually and rises to a logarithmic infinity. This suggests an explanation of the difference observed on seismograms between the sharp arrivals of pP and the blunt arrivals of PP. A.

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534.25

553. ACOUSTIC REFRACTION AND SCATTERING WITH COMPLIANT ELEMENTS. I. MEASUREMENTS IN WATER. W.J.Toulis.
J. Acoust. Soc. Amer., Vol. 29, No. 9, 1021-6 (Sept., 1957).

The velocity of sound in water may be reduced markedly with mechanical structures which effectively increase the compressibility of water. A compliant tube, formed from commercially available round tubing by deforming its cross-section elliptically, is a simple example of such a structure. Compliant tubes are useful in the design of lenses at frequencies below the lowest flexural resonant frequency of a compliant tube immersed in water and reflectors for frequencies up to where the spacing between adjacent compliant tubes corresponds to a half-wavelength. Several measuring techniques were utilized to demonstrate the different aspects of compliant tubes under various conditions of interest. A.

534.25

554. ACOUSTIC REFRACTION AND SCATTERING WITH COMPLIANT ELEMENTS. II. ANALYSIS. W.J.Toulis.
J. Acoust. Soc. Amer., Vol. 29, No. 9, 1027-33 (Sept., 1957).

The characteristic behaviour of a compliant tube to underwater sound is predicted with sufficient accuracy by treating the compliant tube as a clamped-clamped beam and assuming that the distribution of vibration on the beam is independent of the interaction with the fluid medium. This procedure leads to an index of refraction that depends at low frequencies only on the diaphragm volume displacement and the concentration of compliant tubes. The radiation load plays a more significant and variable role in the reflection of sound since it determines, in part, the compliant tube resonant frequency and, therefore, the frequency where practically complete reflection is theoretically possible. Since the radiation load is a complex function of the frequency and the dimensions of the array, a graphical method is suggested in connection with an equivalent circuit to determine the reflection coefficient as a function of frequency. The success of this method requires, in addition, a compatible definition between the radiation load and the mechanical impedance of a compliant tube. A.

534.26

555. SCATTERING OF SOUND WAVES ON SMALL IRREGULARITIES IN A WAVEGUIDE. M.A.Isakovich.
Akust. Zh., Vol. 3, No. 1, 37-45 (1957). In Russian.

A theoretical paper. Calculations are made for singly scattered waves in a plane waveguide (a) when filled with a medium whose refractive index varies from point to point, and (b) when the waveguide is rough but filled with a homogeneous medium. C.R.S.Manders

534.39

556. BOUNDARY LOSSES ASSOCIATED WITH ACOUSTICAL STREAMING. T.F.Hueter.
J. Acoust. Soc. Amer., Vol. 29, No. 6, 735-8 (June, 1957).

The response of an acoustic thermocouple probe to ultrasonic pulses of 0.005 to 1 sec duration exhibits in a sharp transition from low to high boundary dissipation at a critical sound level which depends on frequency. This transition is related to acoustical streaming phenomena in the boundary layer of the thermocouple wire. A connection seems to exist between the onset of turbulence and the formation of cavitation nuclei, although gross cavitation has not been observed. A.

534.62

557. STUDY OF THE SOUND ABSORBERS FOR THE ANECHOIC CHAMBER OF THE PHYSICS FACULTY OF MOSCOW STATE UNIVERSITY. K.A.Velizhanina and S.N.Rzhevkin.
Akust. Zh., Vol. 3, No. 1, 23-8 (1957). In Russian.

In plan the room has the shape of an irregular quadrilateral of area approximately 100 m^2. The height of the chamber is about 7.5 m, the ceiling sloping at some 10^0 to the horizontal. The chamber has a volume of about 650 m^3. The walls and ceiling are not structurally joined with walls of the building. The chamber rests on rubber packing resting on the subsoil. Screw-jacks are provided for raising the chamber so that the packing may be changed. The best absorber for the inside walls etc. for frequencies down to 80 c/s was found to be cones of glass wool, packing density 0.12-0.14 g/cm^3, with an air space between the wall and the base of the cone equal to one-third the height of the cone.

C.R.S.Manders

534.62

558. APPARATUS FOR MEASURING THE ABSORPTION OF ULTRASOUND IN LIQUIDS. G.Laville.
C.R. Acad. Sci. (Paris), Vol. 245, No. 18, 1523-6 (Oct. 28, 1957). In French.

A radiation pressure method is described and applied to the measurement of absorption in aqueous sugar solutions (50 to 400 g/l., 20^0C, 8.014 Mc/s). Irregular absorption in the region 190 to 240 g/l. is attributed to complex associations of sugar and water molecules. H.D.Parbrook

534.7

PHYSIOLOGICAL ACOUSTICS. HEARING. See also under "Medical science. Human physiology". Decimal classification 612.85

OPTICS. RADIATION. SPECTRA

535.313.2 : 535.833

559. THE TWO-MIRROR APLANAT. A.K.Head.
Proc. Phys. Soc. B, Vol. 70, Pt 10, 945-9 (Oct., 1957).

A combination of two aspherical mirrors is considered which is aplanatic (i.e. axially stigmatic and satisfying the exact sine criterion). The shapes of the mirrors are determined analytically in finite form. The Schwarzschild–Chretien aplanatic telescope follows as a special case when one focus is at infinity. A.

535.317

560. A DENSITY FILTER IMPROVING ABERRANT OPTICAL IMAGE. J.Tsujiuchi.
J. Phys. Soc. Japan, Vol. 12, No. 6, 744 (June, 1957).

The Twyman–Green interferogram of a lens was used as an apodising filter, and improved resolution in a defocused image was obtained. Theory shows that the Strehl definition can be improved several-fold in this was for defocusing greater than one wavelength. W.Weinstein

535.317.6 : 518.5

561. AUTOMATIC CORRECTION OF RESIDUAL ABERRATIONS. J.Meiron and H.M.Loebenstein.
J. Opt. Soc. Amer., Vol. 47, No. 12, 1104-9 (Dec., 1957).

A method for the automatic design of optical systems, programmed on an electronic digital computer, is described. The method is based on the reduction of an error function which is determined from the spot diagrams of the system. The minimization is achieved by an iterative advance along the steepest slope of this function. With the aid of Lagragian multipliers secondary demands, such as avoidance of large curvatures, can also be fulfilled. An example of the final correction of a Cooke triplet is outlined. A.

535.327 : 535.345

562. DISPERSION AND ABSORPTION OF LIGHT IN ANTHRACENE CRYSTALS AT 20.4^0K.
M.S.Brodin and A.F.Prikhot'ko.
Optika i Spektrosk., Vol. 2, No. 4, 448-53 (1957). In Russian.

Curves were obtained experimentally for the dispersion and absorption of light in anthracene crystals at 20.4^0K for light vector vibrations parallel, and perpendicular, to the monoclinic axis. The curves of the crystal reflection at these conditions were calculated. The oscillator strengths of the a and b components of the first electron-oscillatory transition in the crystal were determined to be $f_{\parallel b} = 0.12$ and $f_{\perp b} = 0.05$. The oscillator strength of the third component of the crystal spectrum was estimated at $f_{\perp(ab)} = 0.13$. The ratio $f_{\parallel b}/f_{\perp b} \approx 3$ corroborates the assumption that the first transition is polarized along the middle axis of the molecule.

F.Lachman

535.33 : 537.521

563. IMPRISONMENT OF RESONANCE RADIATION IN A GASEOUS DISCHARGE. P.J.Walsh.
Phys. Rev., Vol. 107, No. 2, 338-44 (July 15, 1957).

Following the theory of Holstein (Abstr. 9387/1951), the density, N_r, and the imprisonment lifetime of resonance radiation, T, has been investigated for a gaseous discharge between parallel plates. A general solution is given. Two approximate solutions occur according as the number of electronic de-excitations of the resonance state during the imprisonment time of a photon is much less than or much greater than unity. When this number is much less than unity, N_r can be given by a simple relation which compares well with computations based on the exact solution in the case of Doppler

broadening. T is then essentially equal to the decay time as calculated by Holstein for the decay of resonance radiation following optical excitation. For large number of de-excitations T falls somewhat below the decay value and, as expected, N_T is given by its thermodynamic equilibrium value at the temperature of the electrons. A.

535.33.03 : 535.343

564. FLASH-ABSORPTION SPECTRA OF THE PLASMAS OF ARCS AND OTHER DISCHARGES. W.R.S.Garton and A.Rajaratnam.
Proc. Phys. Soc.A, Vol. 70, Pt 11, 815-23 (Nov., 1957).

A technique is described in which a heavily loaded flash discharge is employed as a background source for observation of absorption spectra, when the absorbing gas column is strongly excited and, therefore, itself brightly luminous. Examples of the absorption spectra of the plasmas of several arc discharges, of both open and screw-stabilized type, are reproduced. Photometric determination of the total absorption under a number of lines, combined with relative emission intensities, yield values of line-reversal temperatures; some first results are reported for copper arcs. A.

535.33.07 : 535.417

565. LIGHT EFFICIENCY OF A SPECTROMETER WITH A FABRY–PEROT INTERFEROMETER. M.P.Chaĭka.
Optika i Spektrosk., Vol. 3, No. 4, 372-9 (1957). In Russian.

Factors determining the light flux in the instrument are examined in several arrangements of the interferometer and cross-dispersing monochromator. The question of light efficiency is discussed for the two conditions when it is determined either by the interferometer or the monochromator. L.Bovey

535.33.07

566. SOME SPECTROPHOTOMETRICAL PROBLEMS IN LIGHT-SCATTERING MEDIA. A.P.Ivanov.
Optika i Spektrosk., Vol. 2, No. 4, 524-9 (1957). In Russian.

Discusses the problem of the sensitivity of spectrophotometrical methods used for light-scattering media and based on (1) the coefficient of absorption of the substance in the disperse phase, and (2) the coefficient of reflection of the powder particles. The ways to increase sensitivity of these methods are indicated. When discussing the question of relating the characteristics of absorption spectra $k(\lambda)$ to those of the reflection spectra, it is found that $(1 - R)^2/R$ is the best function $f(R)$ to represent the absorption spectrum of substances, where R is the coefficient of reflection. F.Lachman

535.331

567. PERTURBATIONS OF THE RESONANCE FREQUENCY 1849.57A OF MERCURY IN PURE MERCURY VAPOUR.
S.Robin and St. Robin.
C.R.Acad.Sci. (Paris), Vol. 244, No. 19, 2375-8 (May 6, 1957).
In French.

The absorption profile of the 1849.57A Hg line was studied as a function of pressure and temperature. The attenuation was found to be proportional to $(\Delta\nu)^{-3/2}$ which is consistent with a c/r^6 intermolecular potential. R.W.Nicholls

535.331

568. SPECTRAL PROFILE AND CAUSES OF BROADENING OF CERTAIN HIGHLY MONOCHROMATIC RADIATIONS OF MERCURY-198. J.Terrien, J.Hamon and T.Masui.
C.R. Acad. Sci. (Paris), Vol. 245, No. 10, 926-9 (Sept. 2, 1957).
In French.

The yellow and green radiations of Hg^{198} from an electrodeless lamp with the external temperature maintained at 2° C were studied with a Fabry–Perot etalon and by the visibility of two-beam interference fringes with a view to their use as a fundamental standard of length. The half-width of the green line is about 20 mK. Analysis of the visibility curve shows that the Doppler half-width is .16 mK, corresponding to a temperature of 38° C; the additional broadening is mainly collision broadening and increases with the pressure of the argon carrier gas. If the external temperature of the lamp is allowed to rise, self-absorption is observed. Excellent agreement between the theoretical and calculated visibilities was found for a lamp at 22° C assuming the effective temperature to be 60° C. A.H.Cook

535.331

569. SPECTRAL PROFILE AND CAUSES OF BROADENING OF CERTAIN HIGHLY MONOCHROMATIC RADIATIONS OF KRYPTON-86. J.Terrien, J. Hamon and T.Masui.
C.R. Acad. Sci. (Paris), Vol. 245, No. 11, 960-3 (Sept. 9, 1957).
In French.

Interferometric measurements were made upon the 5649A and 6056A lines of krypton. They are extremely narrow (~ 0.01A) and do not suffer from self-absorption effects. The 6056A line in particular, which arises from the $2p_{10}$-$5d_5$ transition, is suggested as a new primary standard of length. In comparison with the 6438A line of Cd, its wavelength is: $6057.8021 \times 10^{-10}$ m $\pm$ 0.0001×10^{-10} m, the error being in the lack of reproducibility of the Cd radiation. R.W.Nicholls

535.331

570. PERTURBATION OF THE RESONANCE LINE 1850A OF MERCURY BY COMPRESSED H_2, N_2, A AND Xe.
S.Robin and St. Robin.
C.R. Acad. Sci. (Paris), Vol. 245, No. 13, 1056-60 (Sept. 23, 1957).
In French.

Measurements were made upon the displacement and broadening of the 1850A line of mercury as a function of density by H_2, N_2, A, and Xe. The effects of N_2, A and Xe are similar, and similar to the effects observed (see preceding abstract) for the 2537A line. The effects are smaller in the case of H_2. R.W.Nicholls

535.331

571. NEW GERMANIUM STANDARD WAVELENGTHS IN THE REGION FROM 1998 A TO 1630 A. K.L.Andrew and K.W.Meissner.
J. Opt. Soc. Amer., Vol. 48, No. 1, 31-3 (Jan., 1958).

The application of interferometric and grating measurements in the long wavelength region of the germanium arc spectrum in connection with the extended analysis of this spectrum permits the calculation of precise wavelengths of 69 Ge I lines in the vacuum ultraviolet region on the basis of Ritz's combination principle. This furnishes a welcome enrichment and extension of the list of Ge I vacuum ultraviolet standards obtained by Van Veld and Meissner on the same basis by the use of precision measurements in the short wavelength region. Most of these lines can be recommended as reliable secondary standards in the vacuum region. A.

535.331

572. THE HYPERFINE STRUCTURE OF SOME HOLMIUM LINES. V.B.Belyanin.
Optika i Spektrosk., Vol. 3, No. 4, 322-7 (1957). In Russian.

70 lines in the region 3400-6500 A have been investigated on a Fabry–Perot interferometer and tables of their wavelength, intensity and (for about half the lines) h.f.s. intervals are given. Photographs of certain lines are included and there is a very short discussion on the relation of the experimental data to the electronic configuration. L.Bovey

535.331

573. RELATIVE f-VALUES FOR SOME SCANDIUM LINES. Yu.I.Ostrovskiĭ and N.P.Penkin.
Optika i Spektrosk., Vol. 3, No. 4, 391-3 (1957). In Russian.

33 Sc I lines (excited in a King-type furnace) were examined by the "hooks" method of Rozhdestvenskiĭ. A table gives the f-values for 16 multiplets in which the low-lying levels ^2D, ^4F and ^2F are involved and a comparison is made with theoretical results derived on the basis of L–S coupling. L.Bovey

535.338.3

574. ON THE DETERMINATION OF THE OSCILLATOR STRENGTH BY DIRECT MEASUREMENT OF SPECTRAL LINE WIDTH IN A SOURCE OF FINITE OPTICAL DENSITY. L.M.Biberman.
Optika i Spektrosk., Vol. 3, No. 4, 397-9 (1957). In Russian.

Equations summarizing the method are given and modifications for high density and resonance effects are briefly discussed. L.Bovey

535.34.07

575. A 1 m GRAZING INCIDENCE VACUUM GRATING SPECTROGRAPH FOR PHOTOGRAPHIC AND PHOTOELECTRIC USE. H.Greiner.
Z. InstrumKde, Vol. 65, No. 6, 112-19 (June, 1957). In German.

Details of the construction are given. A hot spark and Pfund capillary discharge are included. Several types of fluorescent coating for the photomultiplier were compared. Spectrograms down to 500 A are shown. The instrument is intended for measuring gaseous absorptions. G.F.Lothian

535.343

576. AN ANALYSIS OF THE ABSORPTION SPECTRUM OF PRASEODYMIUM CHLORIDE. B.R.Judd.
Proc. Roy. Soc. A, Vol. 241, 414-22 (Aug. 20, 1957).

The terms and levels of the configuration f^2, corresponding to Pr^{3+}, are examined. It is shown that it is essential to allow for the breakdown of Russell–Saunders coupling when calculations of the

crystal splittings of several excited levels are made. Evidence is given for identifying the level lying immediately above $^3F_3$ as $^3F_4$. The crystal splittings of $^3H_4$, $^1G_4$, $^3F_3$, $^3P_2$ and $^3P_1$ in $PrCl_3$ are satisfactorily accounted for, and the reasons for the deviations between experiment and theory in the case of $^1D_2$ are discussed. A.

535.343 : 535.37 : 539.374

577. EFFECT OF LOW-TEMPERATURE PLASTIC DEFORMATION UPON THE OPTICAL PROPERTIES OF ALKALI HALIDES. G.Chiarotti.
Phys. Rev., Vol. 107, No. 2, 381-7 (July 15, 1957).

The optical absorption spectrum of KBr and KI crystals, which have been plastically deformed at low temperature, has been observed in the region of the α-band in order to detect single-ion vacancies generated by moving dislocations. As a result of the present experiment no α-band has been observed in KBr and KI crystals plastically deformed at several temperatures between -180^0 C and -125^0 C. The number of α-centres is estimated to be less than 10^{16} cm^{-3} for KBr or KI crystals after 5% of plastic strain. A general broadening of the fundamental absorption band takes place after plastic deformation. On the other hand, a yellow photoluminescence can be excited in the spectral region of the broadened fundamental absorption. A rough proportionality exists between the amount of luminescence and the number of photons absorbed in the region of the crystal responsible for the extra absorption. Annealing at room temperature reduces both luminescence and extra absorption. A qualitative explanation is given, which is based on the present knowledge of defects in alkali halides. A.

535.343 : 535.37

578. A SPECTROSCOPIC STUDY OF ABSORPTION AND LUMINESCENCE OF CUPROUS CHLORIDE INTRODUCED INTO A CRYSTAL OF ROCKSALT. E.F.Gross and A.A.Kaplyanskiĭ.
Optika i Spektrosk., Vol. 2, No. 2, 204-9 (1957). In Russian.

NaCl–CuCl crystals were obtained with a larger CuCl concentration when the latter was distributed in the form of colloidal particles in the NaCl lattice. The absorption and luminescent spectra of the NaCl–CuCl system were recorded at 3846 A and in the 3780-3720 A region at 77.3^0K. Narrow emission bands were found corresponding to the fine absorption bands. The large influence on the absorption and emission spectra of the initial heating and cooling of the NaCl–CuCl crystals was shown.

L.Bovey

535.343

579. FINE STRUCTURE IN THE EXCITON BANDS OF THE ALKALI HALIDES. K.Teegarden.
Phys. Rev., Vol. 108, No. 3, 660-2 (Nov. 1, 1957).

This paper presents new data on the optical absorption spectra of evaporated films of KI, NaI, RbI, NaBr, and KBr in the region between 1700 A and 2500 A. The measurements were made at room temperature and -180^0 C. The absorption spectra of the iodides reveal hitherto unreported structure in the fundamental-band region of the salts. A.

535.343 : 539.19

VIBRATIONAL SPECTRA OF PHOSPHONIUM AND DEUTEROPHOSPHONIUM IODIDES. See Abstr. 386

535.343

580. ON THE STUDY WITH MILLIMETRE WAVES OF THE ROTATION SPECTRUM OF FORMIC ACID. R.Wertheimer.
Ann. Télécomm., Vol. 12, No. 7-8, 253-77 (July-Aug., 1957).
In French.

Describes a spectrometer in which the source of radiation is a harmonic from a klystron oscillator modulated to scan a range of wavelengths. The output appears on a cathode-ray oscillograph. Absorption measurements of formic acid were made at room temperature, and pressure 10^{-2}-10^{-3} mm in the region λ = 2-7 mm 28 lines are reported. They are assigned to transitions of a non-rigid asymmetric rotator and the constants giving moments of inertia in terms of J, K are calculated. G.F.Lothian

535.343

581. MILLIMETER-WAVE SPECTRUM OF FORMIC ACID. G.Erlandsson.
J. chem. Phys., Vol. 28, No. 1, 71-5 (Jan., 1958).

The investigation of the R^a branch of the formic acid rotational spectrum is extended up to J = 9 around 1.5 mm wavelength. The centrifugal distortion corrections are studied in some detail partly by means of sum rules and partly by power series expansions and other approximate methods. A.

535.345.6

582. SOME SIMPLE CHRISTIANSEN FILTERS. L.Auerbach.
Amer. J. Phys., Vol. 25, No. 7, 440-2 (Oct., 1957).

A little-known demonstration in optics, the Christiansen filter, is described. A discussion of its merits and defects for demonstration or research work is included. Some new filter combinations for the visible region are described that are of special value for demonsteation purposes. Special features of several are noted. A.

535.361.2 : 523.322

583. COMPARISON OF THE LAW OF REFLECTION OF LIGHT FOR THE MOON AND FOR CERTAIN KINDS OF ROCKS. N.S.Orlova.
Vestnik Leningrad. Univ. Ser.,Mat. Mekh. Astron., 1957, No. 1, 152-7. In Russian.

The light diffusion of different minerals and rocks (e.g. granite, basalt, sand, and volcanic slags) was studied photometrically. The diffusion curve for slags resembles that for the moon which supports the view that the surface of the moon is covered with slags of meteorite origin. C.R.S.Manders

535.37

584. CHANGES IN INTENSITY DISTRIBUTION OF THE LUMINESCENCE SPECTRA OF ANTHRACENE AND NAPTHALENE. I.Ya.Kucherov, A.N.Faĭdysh and Z.N.Fesenko.
Optika i Spektrosk., Vol. 2, No. 4, 462-9 (1957). In Russian.

Curves of quantum intensity v. wavelength at temperatures in the range -140 to 20^0 C are presented for crystals of varying thickness (T) of: anthracene T ~ 0.3 μ to ~ 0.5 mm; anthracene containing traces of naphthacene T ~ 0.5 mm; and naphthalene T ~ 1.5 mm and ~ 15 μ. The behaviour of anthracene and of anthracene with naphthacene is discussed in some detail. Experimental confirmation for an exciton mechanism of energy transfer in anthracene with naphthacene is claimed. C.H.L.Goodman

535.37

585. APPLICATION OF THE METHOD OF PARAMAGNETIC RESONANCE FOR DETERMINING THE STATE OF ACTIVATORS IN PHOSPHORS.
A.A.Manenkov, A.M.Prokhorov, Z.A.Trapeznikova and M.V.Fok.
Optika i Spektrosk., Vol. 2, No. 4, 470-4 (1957). In Russian.

In powdered SrS activated with Eu the M = $-\frac{1}{2}$ to $+\frac{1}{2}$ transition of the electron resonance of the Eu^{++} is observed and in a single crystal of CaF_2:Eu all transitions of the $^8S_{7/2}$ state are observed with anisotropic line broadenings. From the hyperfine coupling $\mu(Eu^{151})/\mu(Eu^{153}) = +2.24 \pm 0.03$ is obtained. With SrS:Gd there is an absorption line due to the even isotopes with evidence of hyperfine structure which indicates $\mu(Gd^{155}) \sim \mu(Gd^{157}) \sim 0.2$ n.m. Attempts to produce changes of the radiofrequency spectrum on excitation of the phosphors were unsuccessful, no reduction of the SrS:Eu signal being observed on the application of u.v. irradiation and no signal was induced in SrS:Tb with the same irradiation. D.H.Whiffen

535.37 : 537.311.33

586. ON RECOMBINATION-INTERACTION OF THE CENTRES OF BLUE AND GREEN LUMINESCENCE IN THE PHOSPHOR ZnS:Cu. M.V.Fok.
Optika i Spektrosk., Vol. 2, No. 4, 475-9 (1957). In Russian.

The interaction of centres of blue and green luminescence comes about through the migration of holes in the valence zone from one centre to the other. In agreement with the calculation presented it is found that with stimulation in the blue-centre absorption band quenching of the blue band, starting at a certain instant, is slowed down, and proceeds parallel to that of the green. It is also possible to stimulate the blue band with absorption by the centres of green luminescence. In this case the blue band from the start quenches almost parallel to the green. C.H.L.Goodman

535.371

587. CRITICAL COMMENT ON A METHOD FOR DETERMINING ELECTRON TRAP DEPTHS. C.H.Haake.
J. Opt. Soc. Amer., Vol. 47, No. 7, 649-52 (July, 1957).

A method proposed by Garlick and Gibson is often applied to determine the energy positions of traps in phosphors. A critical analysis of Garlick and Gibson's method based on a mathematical determination of the applicable temperature range and on experimental evidence shows that the trap depths obtained are lower than those found by other methods. Especially the frequency-of-escape constants calculated subsequently contrast strongly to those determined by separate measurements. A.

535.371

588. THE TEMPERATURE DEPENDENCE OF THE LUMINESCENCE INTENSITY OF VARIOUS ACTIVATED CdS CRYSTALS. W.Ludwig and R.Seiwert.
Z. phys. Chem. (Leipzig), Vol. 207, No. 3-4, 250-72 (Aug., 1957). In German.

The temperature dependence of luminescence was measured over the range −180 to +120°C using 3650 A excitation. Maxima were shown in the intensity/temperature curves for emission in the 6000-9500 A region. For "pure" crystals the intensity remained essentially constant over a wide temperature range. The results are explained by use of the Klasens–Schön energy-band model of crystal phosphors. G.F.J.Garlick

535.399 : 535.434

589. DEPENDENCE OF THE FORM OF THE STEADY-STATE DIAGRAM OF BRIGHTNESS DISTRIBUTION ON THE ABSORPTION/SCATTERING COEFFICIENT RATIO. V.A.Timofeeva.
Dokl. Akad. Nauk SSSR, Vol. 113, No. 3, 556-9 (1957). In Russian.

Presents the results of studies conducted in various spectral regions, with the angle of vision in the photometer varying in most cases from 5 to 15°. The turbid media tested were usually milk solutions, with or without dye. The coefficient of scattering of these media (k) was determined by means of a König–Martens spectrophotometer; the coefficient of absorption (m_{cr}) was found to be equal to that of the water before the addition of milk. A special technique was used for determining the absolute scattering coefficient in a spectral region which, on the one hand, corresponds to the limiting scattering of light (which is to a large extent filtered off by the medium) and, on the other hand, can be detected by means of the photometer with a light filter. In an earlier paper, the author found that, as the ratio m_{cr}/k increased, the values of $R = B_\varphi = 0/B_\varphi \neq 0$ ($B_\varphi = 0$ is the brightness in the direction towards the light source; $B_\varphi \neq 0$ is the brightness in any other direction) also increased, the diagrams lengthened, the pole moved away from the incident light, and the relative amount of albedo decreased. In the present study it was found that the relationships between R and m_{cr}/k (for different values of φ) are rectilinear and independent of wavelength; the straight lines obtained intersect all at a point whose abscissa will become $m_{cr}/k = 0$, provided that allowance is made for the coefficient of absorption of the pure water (which was found to be 0.014 cm^{-1} for the conditions of the experiment). For other wavelengths the straight lines undergo a parallel shift. The method used in the study can be used for determining the spectral absorption curve of transparent liquid media having a very small coefficient of absorption, e.g. seawater. An empirical relationship $R = 1 + \mu m/k$ is obtained, where μ is a parameter depending on φ (probably also on the polar curve of particle scattering). F.Lachman

535.417 : 531.717.1

590. MULTIPLE-BEAM FRINGES OF EQUAL CHROMATIC ORDER. VIII. METHOD OF COINCIDENCE. W.F.Koehler.
J. Opt. Soc. Amer., Vol. 48, No. 1, 55-7 (Jan., 1958).

For Pt VII see Abstr. 1134 (1956). An interferometric method of coincidence for the measurement of a large step height Δt is reported. The method is based upon the more rigorous interference equation $n = 2t\nu + f$. The term f is a function of ν and is necessary to account for phase changes upon reflection at the boundaries of the interference film when other than zero or π. A.

535.417 : 531.715

591. THE ACCURACY OF INTERFEROMETRIC LENGTH MEASUREMENT. R.Landwehr.
Z. angew. Phys., Vol. 8, No. 11, 561-8 (Nov., 1956). In German.

A review article; summarizes the sources of error in the measurement of the fractional order of interference and discusses the effect of errors in the fractional order on the accuracy of the measurement of length, particularly on the use of the method of exact fractions to determine the order of interference. The results of some experimental tests are reported. A.H.Cook

535.55 : 531.25

592. THE DYNAMIC STRESS-OPTIC COEFFICIENT OF PERSPEX. D.F.Marshall.
Proc. Phys. Soc. B, Vol. 70, Pt 11, 1033-9 (Nov., 1957).

An apparatus based upon the Davies and Kolsky modifications of the Hopkinson pressure bar, and including a plane polariscope, was used to measure the dynamic stress-optic coefficient of a bar of Perspex whilst the material was being subjected to a stress cycle of about 50 microseconds duration. A value of 11 Brewsters was obtained for the coefficient of the particular sample of Perspex used, compared with a value of 23.4 Brewsters obtained by subjecting the same specimen to a static load. A.

535.7

PHYSIOLOGICAL OPTICS. VISION. See under "Medical science. Human physiology". Decimal classification 612.84

535.81 : 621.397.331.2

593. NEW EQUIPMENT AND METHODS FOR THE EVALUATION OF THE PERFORMANCE OF LENSES FOR TELEVISION. W.N.Sproson.
B.B.C. Engng Monogr., No. 15, 16 pp. (Dec., 1957).

Provides an outline of the photoelectric method of testing lenses, together with some details of the two types of test pattern in use in the B.B.C. Research Department and the form of aperture correction necessitated by the finite width of the scanning slit. The photoelectric test bench is described and a few preliminary results are quoted. The integration of response curves obtained from the photoelectric bench is made to yield a single figure which indicates the performance of a lens over the whole of its field. Factors affecting the quality of a picture, such as variation in definition over the field and vignetting, are discussed. The experimental basis for an index is given and formulae are developed for monochrome television and colour television indices. A.

535.89 : 537.311.33

MULTIPLE-BEAM APLANATIC RADIATORS AND DETECTORS. See Abstr. 188

HEAT

536.27 : 532.25 : 538.6

594. EXPERIMENTS ON THE INSTABILITY OF A LAYER OF MERCURY HEATED FROM BELOW AND SUBJECT TO THE SIMULTANEOUS ACTION OF A MAGNETIC FIELD AND ROTATION. Y.Nakagawa.
Proc. Roy Soc. A, Vol. 242, 81-8 (Oct. 15, 1957).

Experiments on the onset of thermal convection in a rotating layer of mercury heated from below and subject to an impressed magnetic field are described. Experiments were performed for values of the parameter $Q_1 (= \sigma H^2 d^2/\pi^2 \rho \nu$, where H denotes the strength of the magnetic field, ρ the density of fluid and σ the coefficient of electrical conductivity) varying between 9.85 and 2.01×10^4 and a value approximately 10^6 for the parameter $T_1 (= 4\Omega^2 d^4/\pi^4 \nu^2$, where Ω is the angular velocity of rotation, d the depth of the layer and ν the coefficient of kinematic viscosity). The critical Rayleigh number R_C for the onset of instability as well as the manner of its occurrence — overstability or cellular convection — were determined for fourteen different values of Q_1. In agreement with Chandrasekhar's theoretical predictions, the experiments confirm that the transition between overstability and convection occurs discontinuously at a critical field strength (when the angular velocity is maintained constant). The nature of the dependence of R_C and Q_1 (for given T_1) is also in agreement with theory. A.

536.46

595. MEASUREMENT OF THE BURNING CONSTANT OF A FUEL DROP. B.J.Wood and H.Wise.
J. appl. Phys., Vol. 28, No. 9, 1068 (Sept., 1957).

An optical apparatus is described for studying directly the time variation of area of a burning spherical droplet at the end of a quartz fibre. The rate of change of cross-sectional area should be a constant, termed the burning constant. Values of this are given for ethanol, butanol, oxydiethanol, hexadecane, kerosene and jet fuel. A.G.Gaydon

536.48

596. THE ABSORPTION OF SOUND IN LIQUID HELIUM. II. K.Dransfeld, J.A.Newell and J.Wilks.
Proc. Roy. Soc. A, Vol. 243, No. 1235, 500-17 (1958).

The absorption of sound in liquid helium II has been measured in the temperature range down to 0.4°K, at frequencies of 6.0 and 14.4 Mc/s and under pressures of up to 25 atm. The results are compared with the theory of Khalatnikov (Abstr. 6451/1950, 3258/1953). Besides accounting for the existence of a maximum in the absorption–temperature curve, this theory predicts the manner in which the magnitude and position of the maximum varies with frequency, and with pressure. It is shown thatthese predictions are qualitatively correct, although exact numerical agreement is not obtained. The measurements also confirm the observations of Chase and Herlin (Abstr. 4599/1955) that the absorption at the lower temperatures is greater than that to be expected from Khalatnikov's original treatment. It seems that the additional absorption may arise from processes associated with the kinetic coefficient of thermal transport (Khalatnikov, Abstr. 3258/1953). A.

536.48

597. VISUAL OBSERVATION OF PHASE SEPARATION OF He^3–He^4 SOLUTIONS. V.P.Peshkov and K.N.Zinov'eva.
Zh. éksper. teor. Fiz., Vol. 32, No. 5, 1256-7 (1957). In Russian.

Separation into two phases of a 51.1% solution of He^3 in He^4 was observed visually to occur below 0.81°K in agreement with Walters and Fairbank's result (Abstr. 8737/1956) based on nuclear resonance observations. About 0.2 cm^3 of solution was used in an ampoule cooled in a bath containing about 3 cm^3 of liquid He^3. Preliminary tests suggest that both phases are superfluids.
D.Shoenberg

536.631 : 536.658.2

598. THE SPECIFIC HEAT AND HEAT OF WETTING OF WOOD. R.F.S.Hearmon and J.N.Burcham.
Chem. and Industr., No. 31, 807-8 (Aug. 11, 1956).

It is established that in moist wood the measured specific heat is greater than that calculated from the proportions and specific heats of the components, assuming a simple mixture law. A thermodynamic relationship connecting the excess specific heat with the temperature coefficient of heat of wetting is verified experimentally.
R.F.S.Hearmon

536.631 : 536.48

599. HEAT CAPACITY OF CALCIUM FROM 1.8 TO 4.2°K. M.Griffel, R.W.Vest and J.F.Smith.
J. chem. Phys., Vol. 27, No. 6, 1267-9 (Dec., 1957).

The heat capacity of high-purity calcium was measured over the temperature interval from 1.8 to 4.2°K. The electronic contribution is linear in T and the coefficient γ is 3.08 ± 0.01 millijoules/(gram-atom) deg^2 corresponding to a density of states at the Fermi level of 0.653 momentum state per electron volt per atom. A Debye temperature of 239 ± 2°K was obtained. For purposes of testing the calorimeter, the heat capacity of copper was determined. In agreement with other recent measurements, the value obtained for γ is 0.691 ± 0.006 millijoule/(gram-atom) deg^2 and θ_D is 342 ± 2°K.
A.

536.633.3

600. THE "RATIO OF THE SPECIFIC HEATS" AND THERMODYNAMICS. L.G.Hoxton.
Amer. J. Phys., Vol. 25, No. 7, 460-2 (Oct., 1957).

Attention is directed to certain adiabatic equations, which are deducible from definitions independent of thermodynamic principles. The facts appear to be little known; textbooks and other writings disagree about them. The very simple proofs discussed here result in economy of thought with attendant benefits to both student and instructor.
A.

ELECTRICITY

ELECTROSTATICS. DIELECTRICS

537.212 : 621.319.7

601. CERTAIN PROPERTIES OF THE ELECTROSTATIC FIELD OF TWO SPHERES. B.Konorski.
Arch. Elektrotech. (Berlin), Vol. 43, No. 4, 225-49 (1957). In German.

A detailed mathematical analysis of the classical problem of the spatial field determined by two charged spheres at a finite distance apart. The method of images is worked out fully and values for the field strength and induced charge are tabulated for a range of values of all the relevant parameters.
L.S.Goddard

537.222

602. NEGLECTED QUADRUPOLE. G.Arfken.
Amer. J. Phys., Vol. 25, No. 7, 481-3 (Oct., 1957).

The usual textbook developments of the electric dipole potential are discussed and the limitations, some inherent and some arbitrary, are noted. Introducing Legendre polynomials by their generating function an alternate derivation is presented. This latter approach offers the double advantage of introducing the undergraduate to quadrupoles and higher multipoles and providing him with a powerful mathematical tool for treating electrostatic and many other problems. The importance of the quadrupole concept in modern physics is emphasized.
A.

537.226.1

603. THEORY OF THE DIELECTRIC CONSTANT OF IMPERFECT GASES AND DILUTE SOLUTIONS. T.L.Hill.
J. chem. Phys., Vol. 28, No. 1, 61-6 (Jan., 1958).

General statistical mechanical equations are derived for the polarization, Clausius–Mossotti function, dielectric constant and electrostriction of an imperfect gas. Results are given in the form of series expansions which are closely related to the conventional virial expansion of a gas. The coefficients in the expansions for the polarization, etc., can be evaluated by a consideration of sets of only two, three, etc., molecules in the presence of the external electric field. A similar treatment of a binary solution is also included.
A.

537.226.1 : 539.132

INDUCED POLARIZATION AND DIELECTRIC CONSTANT OF POLAR LIQUIDS. See Abstr. 385

537.226.2

604. THE DIELECTRIC PROPERTIES OF METHYL AND ETHYL ALCOHOLS IN THE WAVELENGTH RANGE 3 cm–52 cm. E.H.Grant.
Proc. Phys. Soc. B, Vol. 70, Pt 10, 937-44 (Oct., 1957).

Measurements have been made of the dielectric properties of methyl and ethyl alcohols in the wavelength range 3-52 cm. It is concluded that the dielectric behaviour of both alcohols can be described in terms of a principal dispersion region at centimetre wavelengths together with a subsidiary dispersion region occurring at millimetre wavelengths.
A.

537.226.2

605. THE POLARIZATION REVERSAL PROCESS IN GUANIDINE ALUMINIUM SULPHATE HEXAHYDRATE. M.Prutton.
Proc. Phys. Soc. B, Vol. 70, Pt 11, 1064-8 (Nov., 1957).

The activation fields of guanidine aluminium sulphate hexahydrate found by three methods are compared. Only over part of the range of fields used is the polarization reversal process characterized by a simple exponential dependence on the field as in $BaTiO_3$. The coercivity and rate of change of polarization are shown to be dependent more upon the rate of change of switching field than upon the frequency or repetition rate.
A.

537.226.32 : 621.319.2

606. EXPERIMENTS ON ELECTRETS. F.I.Polovikov.
Elektrichestvo, 1957, No. 9, 58-9. In Russian.

Preparation of electrets is briefly described. Relevant data are given for the following materials: paraffin, naphthalene, sulphur, ebonite and Plexiglass.
W.Bezdel

ELECTRIC CONDUCTION. CURRENTS

537.311.31 : 537.312.8

607. ANOMALOUS ELECTRICAL RESISTIVITY AND MAGNETORESISTANCE DUE TO AN s–d INTERACTION IN Cu–Mn ALLOYS. K.Yosida.
Phys. Rev., Vol. 107, No. 2, 396-403 (July 15, 1957).

The effect of the s–d exchange interaction between the conduction electrons and the Mn ions on the electrical behaviour of Cu–Mn alloys is investigated from the molecular-field point of view. The magnitude of the anomalous resistivity calculated with the value of the exchange integral for a free Mn^+ ion agrees with the experimental value within a factor of three. Also the temperature dependence of the resistivity obtained by the molecular-field approximation for the antiferromagnetic spin ordering is shown to be quite similar to the behaviour exhibited by the alloys with more than 1% (atomic) of Mn. For samples with lower concentration of Mn ions, however, the theoretical result shows only a monotonic decrease of the resistance below the Néel temperature. It shows neither the resistance minimum nor maximum which has been found experimentally for the very dilute alloys. The anomalous magnetoresistance calculated on the same basis is approximately proportional to the square of the magnetization and its magnitude is in good agreement with the experimental results, especially above the Néel temperature. The magnetoresistance of ferromagnetic metals is also discussed.
A.

537.311.31 : 539.87

608. THE EFFECT OF PRESSURE ON THE ELECTRICAL RESISTANCE OF COPPER AT LOW TEMPERATURES. J.S.Dugdale and D.Gugan.
Proc. Roy. Soc. A, Vol. 241, 397-407 (Aug. 20, 1957).

The resistivity of copper under hydrostatic pressures up to

3000 atm was measured at temperatures between 4°K and room temperature. Two specimens of commercially pure copper (99.98%) and an alloy of 0.056 at. % iron in copper were studied, the alloy being chosen because it showed a large resistance minimum. The effect of pressure on the ideal resistivity is in good agreement with Grüneisen's theory. There were some theoretical reasons for expecting that the alloy would have a large pressure coefficient of resistivity at or below the temperature of the resistance minimum. The pressure coefficient at these temperatures was, however, quite small and similar in value to the pressure coefficients of residual resistivity of the two purer specimens. Both the residual resistivity of the alloy and its pressure coefficient appeared to be strongly dependent on temperature. A.

537.311.33

609. CYCLOTRON RESONANCE OVER A WIDE TEMPERATURE RANGE. D.M.S.Bagguley, J.A.Powell and D.J.Taylor.
Proc. Phys. Soc. A, Vol. 70, Pt 10, 759-62 (Oct., 1957).

By doping Ge with Au, samples were prepared in which the carrier concentration remained reasonably small up to about 90°K, so that cyclotron resonance observations were not obscured by plasma effects. With this material it is found that in the range from 4 to 65°K the heavy holes, as well as the light holes, have practically isotropic effective mass ($m^*/m = 0.30 \pm 0.02$, 0.045 ± 0.002 respectively), and the relaxation time for both is about 0.5×10^{-11} sec, independent of temperature. It is estimated that the relative number of heavy and light holes is about 50 : 1. These figures are compared with those obtained from other data. R.G.Chambers

537.311.33

610. ON THE THEORY OF THE THERMAL CAPTURE OF ELECTRONS IN SEMI-CONDUCTORS. G.Rickayzen.
Proc. Roy. Soc. A, Vol. 241, 480-94 (Sept. 10, 1957).

The influence of the acoustic vibrations of the lattice on the capture of free carriers by impurities is investigated theoretically. The bound states considered are those whose energies are near the middle of the energy gap. For these states it is assumed that the interaction between the electron and the lattice is adequately described in the adiabatic approximation. It is also assumed that the bound electron displaces the equilibrium positions of the atoms of the lattice, but that it does not alter the velocity of sound in the solid. If this is the case, the ratio of the probability that the impurity will be ionized to the probability that the free carrier will be captured is $\exp(-E_I/kT)$, where E_I is the ionization energy. The principal new result is a formula for the capture rate which is valid when E_I/k is very much greater than the Debye temperature. The formal theory is applied to the model of an impurity in a continuum. The capture rate is strongly dependent on the radius of the bound orbit, on the strength of the coupling between the electron and the lattice and on the temperature when the ionization energy is sufficiently large. The limitations of the model are discussed and the results are compared with experiment. The qualitative features of the model are, for certain values of the unknown parameters, in agreement with experiment although the absolute magnitudes of the capture rates may be too small to account for the observed lifetimes. A.

537.311.33 : 621.315.59

611. QUASI-ELECTRIC AND QUASI-MAGNETIC FIELDS IN NONUNIFORM SEMICONDUCTORS. H.Kroemer.
R.C.A. Rev., Vol. 18, No. 3, 332-42 (Sept., 1957).

In a chemically uniform semiconductor with a constant impurity concentration and without elastic strains, the forbidden band has a constant width, and there are no internal electric fields. A non-homogeneous impurity distribution introduces electric fields, while non-uniform elastic strains introduce a nonuniform bandwidth. If the semiconductor is an alloy, such as a germanium–silicon alloy, a change in the alloy composition also changes the bandwidth. A change in bandwidth means gradients of the band-edges which are different for the conduction and the valence bands. These gradients act upon the electron and hole movement as though they were electric fields, but, because the two slopes are different, these "quasi-electric" fields are not the same for electrons and holes, contrary to the case of real electric fields. In addition, a type of "quasi-magnetic" field is produced when an inhomogeneity produces a shift of the location within the Brillouin zone of the energy minimum of the band. These quasi-magnetic fields not only are different for electrons and holes but they are also different for the electron (holes) inside the various energy minima of that band. A.

537.311.33 : 621.315.59

612. SEMICONDUCTORS CONSIDERED AS IONIZED MEDIA. M.Demontvignier.
Rev. gén. Elect., Vol. 66, No. 10, 495-512 (Oct., 1957). In French.

The formulae for the concentrations of free charge carriers, their generation and recombination rates, and several derived electrical properties are deduced from considerations of a tetravalent crystal of the diamond structure, using an atomistic approach, rather than the band theory. C.A.Hogarth

537.311.33

613. DISTRIBUTION AND CROSS-SECTIONS OF FAST STATES ON GERMANIUM SURFACES IN DIFFERENT GASEOUS AMBIENTS. A.Many and D.Gerlich.
Phys. Rev., Vol. 107, No. 2, 404-11 (July 15, 1957).

Simultaneous measurements of surface recombination velocity and trapped charge density in the fast states as a function of surface potential are carried out on germanium surfaces at fixed gaseous ambients and temperatures. The surface potential is varied over a range of about 10 kT/q by the application of a.c. fields normal to the surface. For the surfaces studied, the distribution in energy of the fast states is found to consist of four discrete sets of levels. Only one of these sets is significant in the recombination process, being characterized by relatively high capture cross-sections for holes and electrons. Another set has negligible cross-sections and appears only in the field-effect data. The two remaining sets of levels lie outside the range of surface potential attained and little can be said about their properties. Detailed investigation of the surface recombination process shows that the energy level of the recombination centres is temperature-dependent, increasing slightly as the temperature is decreased. The field-effect data indicate that such is also the case for the other surface states. Repeated measurements on the same sample over a long period in vacuo and in various gaseous ambients show that the structure of the fast states is markedly affected by these ambients. Initially, with the sample in vacuo, rapid changes in interface structure take place: the energy levels, the density, the ratio of the capture cross-section for holes to that for electrons, as well as the cross-sections themselves, all decrease with time. After a few days in vacuo, stabilization is essentially reached; following that, repeated exposures to different ambients result in reproducible changes in structure which persist for many weeks. A.

537.311.33 : 539.2

INTERACTION BETWEEN ELECTRONS AND LATTICE VIBRATIONS. See Abstr. 395

537.311.33

614. CURRENT–CAPACITANCE CHARACTERISTICS OF METAL RECTIFIERS. Y.Moriguchi and A.Okazaki.
Proc. Phys. Soc. B, Vol. 70, Pt 10, 991-9 (Oct., 1957).

Using a substitution bridge method, the reverse current–voltage and capacitance–voltage characteristics of metal rectifiers have been measured at room and liquid-air temperatures. At low temperatures the capacitance of Cu_2O and Se rectifiers, and the reverse current of the former, decrease, but that of the latter increases. The capacitance–voltage characteristics seem to be in good agreement with Landsberg's heterogeneous barrier-layer theory, and the comparison of the experimental results with this theory gives effective dielectric constants of 4.3 and 2.0-4.3 for the barrier materials of Cu_2O and Se rectifiers, respectively. A.

537.311.35

615. HIGH-FIELD CONDUCTION CURRENTS IN HEXANE. H.House.
Proc. Phys. Soc. B, Vol. 70, Pt 10, 913-27 (Oct., 1957).

The author has been able to measure conductivity currents in hexane up to the breakdown stress by using a conditioning process which enables a stable state of the electrodes and liquid to be kept for many hours. It is shown that the results are consistent with a theory of electron emission from the cathode, and that the dominant process is the Schottky one, together with the mathematically similar barrier-peak-tunnelling component. The work function is found to be 1.0 to 1.2 eV, although this may contain a bulk-liquid component. For stresses of 1 MV cm^{-1} and greater, evidence is given of an ionization process within the liquid. Due to the difficulties of analysis, caused by the use of spherical electrodes, no estimate of the ionization increment factor α can be given. The tests give no information on the possibility of transient changes in the cathode state due to its inability rapidly to neutralize ionized particles reaching it. A.

537.312.5 : 548.7

616. PHOTOCONDUCTIVITY OF Z BANDS IN KCl AND AN ASSOCIATED NEW BAND. G.R.Cole and R.J.Friauf.
Phys. Rev., Vol. 107, No. 2, 387-91 (July 15, 1957).

Photoconductivity measurements were made on coloured KCl crystals, both pure and strontium doped. Assuming the room-temperature quantum efficiency for photoconductivity of the F centre to be unity, the room-temperature quantum efficiencies of the Z_1 and Z_2 bands are found to be 0.3 ± 0.03 and 1.0 ± 0.2, respectively. The comparison of these results to the previously reported observations on optical bleaching is discussed. Estimates of quantum efficiencies for other bands in pure crystals are R_1, 0.9; R_2, 0.5; M, 0.15; N, 0.6, with an accuracy of about 25%. Low-temperature absorption measurements (100°K) accompanying this work show a small band at 860 millimicrons in the doped crystals. Its proximity to the M band prevents complete resolution, but its behaviour is similar to that of the Z_1 band. The possibility of contamination by an unknown impurity exists, but it seems likely that the new band is genuinely due to the strontium additive. It has been named the Z_4 band, and probable models for the Z_4 centre are considered. A.

537.312.5 : 541.124

617. THE REACTION OF OXYGEN WITH LEAD SELENIDE. R.H.Jones.
Proc. Phys. Soc. B, Vol. 70, Pt 11, 1025-32 (Nov., 1957).

Measurements are described of the oxidation of lead selenide, in the form of a powdered single crystal, at various temperatures in the range from room temperature to 280°C. These were aimed at gaining fundamental information about the photoconductive sensitization of evaporated layers of lead selenide by oxygen. Results obtained indicate that two processes occur during oxidation. In the range of temperature considered the predominating process appears to be the diffusion of oxygen ions to vacant selenium sites in the lattice; this was found to have an activation energy of 17 kcal mol^{-1}. The second process reveals itself only at the highest temperature employed, and is believed to determine the oxidation rate when all or nearly all the selenium vacancies are occupied by oxygen ions. The postulation of two oxidation processes is supported by earlier electrical measurements on lead selenide evaporated layers exposed to oxygen. Theories of photoconductivity in evaporated lead selenide layers sensitized by oxygen are discussed in relation to these experiments. A.

537.312.5

618. ON THE TRANSPORT OF EXCITATION ENERGY IN ZnS AND CdS CRYSTALS. M.Balkanski and I.Broser.
Z.Elektrochem., Vol. 61, No. 6, 715-23 (1957). In German.

Crystals were illuminated with a narrow beam of light and the density of excited states, at various positions and at various times, was determined by measuring the local conductivity. Two diffusion processes with different diffusion lengths were observed. The measurements showed that energy transport over larger distances (diffusion length about 0.3 cm) could not be due to charged carriers, but may arise from the diffusion of excitons (electron–hole pairs) or the scattering of luminescent light. R.Stratton

537.312.62

619. SUPERCONDUCTIVITY IN THE PERIODIC SYSTEM. D.Pines.
Phys. Rev., Vol. 109, No. 2, 280-7 (Jan. 15, 1958).

The empirical regularities in the appearance of superconductivity in the periodic system discussed by Matthias are considered in the light of the microscopic theory of superconductivity proposed by Bardeen, Cooper, and Schrieffer. A simple model of electrons and ions interacting via screened Coulomb forces is used to describe the electron–lattice interaction. With the aid of this model, it is shown how the theory of Bardeen, Cooper, and Schrieffer provides both a satisfactory criterion for the appearance of superconductivity and a good qualitative account of the variation in transition temperature from one metal to another. A.

537.312.62 : 536.424

620. THE SUPERCOOLING EFFECT IN SUPERCONDUCTORS CLOSE TO THE TRANSITION TEMPERATURE. T.E.Faber.
Proc. Roy. Soc. A, Vol. 241, 531-46 (Sept. 10, 1957).

The extent to which a superconducting metal can be supercooled is usually limited by the presence of flaws, which act as centres for nucleation. Close to the transition temperature, however, the flaws are too small to be effective, and the supercooling which is then observed appears to be characteristic of the ideal metal. This ideal supercooling was accurately measured for aluminium, indium, and tin, with the object of testing the various phenomenological theories of superconductivity which have lately been proposed. None of the theories is found to be completely successful. A.

537.312.8 : 538.632

621. GALVANOMAGNETIC THEORY FOR N-TYPE GERMANIUM AND SILICON: HALL THEORY AND GENERAL BEHAVIOR OF MAGNETORESISTANCE. L.Gold and L.M.Roth.
Phys. Rev., Vol. 107, No. 2, 358-64 (July 15, 1957).

A general expression for the resistivity tensor, appropriate to n-type germanium and silicon, is deduced from which the magnetoresistance $\Delta\rho/\rho$ and Hall coefficient R_H relations are evaluated. The angular dependence of $\Delta\rho/\rho$ in germanium shows precisely the qualitative features noted in the experiments of Pearson and Suhl. Additional details emerge, however, for silicon that were not detected by Pearson and Herring — presumably because of the restricted range of $\omega\tau$ they employed. The field dependence of $\Delta\rho/\rho$ for both germanium and silicon is examined for a number of high-symmetry orientations of the current J and magnetic B vectors with the finding of a departure from the square law at high fields. A detailed study of the R_H field dependence is made for the combinations J_{100}, B_{010}, and J_{110}, $B_{1\bar{1}0}$. A minimum is observed in germanium for the latter case and in silicon for the former case. The minima occur between the limiting values for $b \to \infty$, $R_H = 1/nqc$ and $b \to 0$, $R_H = (1/nqc)[3K(K+2)/(2K+1)^2]$; these limiting values are invariant for all alignments of J and B. A.

537.312.8 : 535.345

622. PHOTOELECTROMAGNETIC EFFECT IN INDIUM ARSENIDE. J.R.Dixon.
Phys. Rev., Vol. 107, No. 2, 374-8 (July 15, 1957).

When light is strongly absorbed on the surface of a semiconductor placed in a magnetic field whose direction is perpendicular to the normal of the illuminated surface, an electric current is generated. This is called the photoelectromagnetic (PEM) or photomagnetoelectric (PME) effect. It results from the fact that the electrons and holes created at the surface by the incident light are deflected in opposite directions by the magnetic field as they diffuse into the body of the semiconductor. An experimental study of the photoelectromagnetic (PEM) effect in single crystals of n-type and p-type indium arsenide at room temperature is described. For n-type material it is found that the PEM short-circuit current is proportional to the magnetic induction for both high and low surface recombination velocities. In contrast, the PEM short-circuit current for p-type material is found to be nonlinear with respect to the magnetic induction; and the degree of nonlinearity depends markedly on the surface recombination velocity. It is shown that these results are consistent with the theoretical relations proposed by Kurnick and Zitter (Abstr. 2891/1956). Values for the bulk lifetime of electrons and holes are calculated using the PEM effect and photoconductivity data and are found to be approximately 6×10^{-8} sec for n-type material and 5×10^{-10} sec for p-type material. Estimations based on experimental data indicate that the surface recombination velocity for n-type material is in the range from 0 to 10^3 cm/sec for an etched surface and equal to 10^5 cm/sec for a hand-ground surface. It is shown that large errors can be made in the measured values of the bulk lifetime when the spectral range of the exciting light includes the absorption-edge region. A.

537.312.8 : 538.24

MAGNETORESISTANCE OF SOME DILUTE ALLOYS OF Mn IN Cu. See Abstr. 233

537.312.9 : 537.323 : 539.215 : 539.89

623. CONTACT EFFECTS RESULTING FROM COMPRESSION AND FLASH SINTERING IN GRAPHITE POWDERS. F.A.Lewis, J.Orr and A.R.Ubbelohde.
Proc. Phys. Soc. B, Vol. 70, Pt 10, 928-36 (Oct., 1957).

Experiments are described on contact resistance effects in graphite powders: (1) as these are progressively compressed up to 3600 kg/cm^2 in the cold: this produces a marked decrease of electrical resistance, though it seems unlikely that much compression of the actual crystal lattice of graphite is effected; (ii) when loosely pressed powder is subjected to flash discharges from a bank of charged condensers ("flash sintering"): this is in order to explore possible mechanisms of sintering that avoid any prolonged heating of the graphite at high temperatures. In the case of powdered polycrystalline graphite, both (i) and (ii) lead to a marked lowering and stabilization of the electrical resistance. Their influence on the thermoelectric power is discussed. "Flash sintering" promises to be a useful and accessible technique in studying the conductance of crystal compounds of graphite. The results throw a significant light on the nature of the conductance barriers in graphite powders. A.

537.321 : 621.362

624. A NEW THERMOELECTRIC PHENOMENON.
M.S.Morgulis.
Elektrichestvo, 1957, No. 9, 59-60. In Russian.

A thermo-e.m.f. is set up in a homogeneous wire when a temperature gradient existing in it is displaced, e.g. a flame is moved along the wire. The e.m.f. increases with the speed of displacement and changes sign when the direction of displacement is reversed. Heavier currents are set up in thinner wires, which heat and cool more rapidly. Electrical Research Association

537.323

625. THERMOELECTRIC EFFECTS SHOWN BY CERTAIN OXIDES. STUDY OF CUPRIC OXIDE.
G.Péri, M.Pérrot and J.Robert.
J. Phys. Radium, Vol. 18, No. 4, 282-3 (April, 1957). In French.

This material of commercial grade in powder form was pressed between copper electrodes. The conductivity had a similar exponential dependence on temperature as other oxide semiconductors. For a temperature difference between the electrodes the hot one became negative, unlike various other oxides studied. D.Haneman

537.324 : 536.483

626. PERFORMANCE OF COMPOSITE PELTIER JUNCTIONS OF Bi_2Te_3. T.S.Shilliday.
J. appl. Phys., Vol. 28, No. 9, 1035-42 (Sept., 1957).

An experimental Peltier refrigerator utilizing thermoelements of annular configuration has been designed, constructed, and operated. The thermoelectric materials used are p- and n-type Bi_2Te_3 with $\rho_p = 2 \times 10^{-3}$ ohm.cm, $e_p = 180$ μvolts/deg C, $\rho_n = 8.5 \times 10^{-4}$ ohm.cm, and $e_n = -150$ μvolts/deg C. The device has been operated under "no-load" conditions over a range of power inputs and has exhibited a maximum ΔT of 49°C. A simple theory relating to the performance of Peltier thermocouples is derived. Experimental performance of the device is shown to agree with theoretical predictions within experimental error. A.

537.331.33 : 536.421.1

627. ELECTRICAL PROPERTIES OF TELLURIUM AT THE MELTING POINT AND IN THE LIQUID STATE.
A.S.Epstein, H.Fritzsche and K.Lark-Horovitz.
Phys. Rev., Vol. 107, No. 2, 412-19 (July 15, 1957).

The electrical resistivity, the Hall coefficient, and the thermoelectric power of spectroscopically pure tellurium decrease abruptly on melting. The Hall coefficient and the thermoelectric power remain positive above the melting point up to approximately 575°C where they reverse their sign and above which they remain negative up to the highest temperatures measured. The resistivity continues to decrease with rising temperature in the liquid until it approaches a constant value at about 650°C. The experimental results indicate that semiconducting properties persist in the liquid state and that a gradual transition to metallic conduction takes place at higher temperatures. A.

537.331.33

628. ELECTRICAL PROPERTIES OF BORON SINGLE CRYSTALS. W.C.Shaw, D.E.Hudson and G.C.Danielson.
Phys. Rev., Vol. 107, No. 2, 419-27 (July 15, 1957).

The electrical resistivity, Hall coefficient, and thermoelectric power of microscopic boron single crystals were measured as a function of temperature. Rectification and photoconductivity effects were observed at room temperature. The large majority of these single crystals had a high resistivity (about 1.7×10^6 ohm.cm at 300°K) which decreased by a factor of nearly 10^{10} as the temperature was increased from 200°K to 1000°K. A few crystals, however, had a much lower resistivity at 300°K (less than 100 ohm.cm) and at this temperature their resistivity decreased much more slowly with increasing temperature. Such behaviour is attributed to donor impurity levels. From data in the high-temperature range (800°K to 1000°K) the energy gap between the filled band and conduction band was calculated to be 1.55 ± 0.05 eV. Hall, thermoelectric, and rectification studies indicated that hole conduction predominated for all crystals at high temperatures but that electron conduction predominated for the low-resistivity crystals near 300°K. The mobilities of the charge carriers at 300°K were found to be the order of one $cm^2\ volt^{-1}\ sec^{-1}$ with the hole mobility the larger. Nonohmic conduction was observed and shown to arise from Joule heating. A.

ELECTRIC DISCHARGES

537.52 : 533.7 : 530.162

SIMPLIFICATION OF THE EQUATIONS FOR THE DISTRIBUTION FUNCTION OF ELECTRONS IN PLASMA. See Abstr. 526

537.521 : 535.33

IMPRISONMENT OF RESONANCE RADIATION IN A GASEOUS DISCHARGE. See Abstr. 563

537.523.5

629. ON THE MECHANISM OF ELECTRON EMISSION IN ARCS WITH LOW BOILING POINT CATHODES. T.H.Lee.
J. appl. Phys., Vol. 28, No. 8, 920 (Aug., 1957).

It is suggested that electron emission from Cu and Ag of density 10^5 to 10^6 amp/cm^2 can be explained by the fact that the effects of temperature and field emission on current density are not linear as previously assumed. J.W.Sturgess

537.525 : 534.222.2

630. PRODUCTION OF HIGH-ENERGY PLASMAS BY MAGNETICALLY DRIVEN SHOCK WAVES. A.C.Kolb.
Phys. Rev., Vol. 107, No. 2, 345-50 (July 15, 1957).

High-voltage discharges (5-100 kilovolts) with peak currents in 0.3 to 5 microseconds have been used to produce shock waves in deuterium plasmas. The discharge is struck in a transverse magnetic field and the resultant Lorentz force drives the plasma out of the region of the discharge into a quartz side arm. Velocity measurements of the magnetically driven plasma are discussed in relation to the parameters of the discharge. These measurements indicate that deuterium plasma with ion energies > 100 eV/ion at densities $> 5 \times 10^{16}$ ions/cm^3 can be produced by this method. A.

537.525 : 538.63

631. THE INFLUENCE OF AN AXIAL MAGNETIC FIELD ON THE STABILITY OF A CONSTRICTED GAS DISCHARGE.
R.J.Tayler.
Proc. Phys. Soc. B, Vol. 70, Pt 11, 1049-63 (Nov., 1957).

It is shown that a suitable arrangement of axial magnetic fields and conducting walls will stabilize a constricted gas discharge if all the discharge current flows on its surface. For stability the axial field in the discharge exceeds that in the low density region surrounding it and the wall radius cannot exceed the discharge radius by more than a factor of five. In the other extreme case, when the axial current is uniformly distributed across the discharge and the internal field cannot exceed the external field, no complete stability results. The problem of the stability of general current and field configurations is reduced to the solution of two first order differential equations and a dispersion relation. These equations are discussed qualitatively and a generalization obtained of a sufficiency condition for stability in the absence of an axial field, which was given in a previous paper. A.

537.525 : 539.17

PRODUCTION OF HIGH TEMPERATURES AND NUCLEAR REACTIONS IN A GAS DISCHARGE. See Abstr. 773-9

537.525.4 : 534.222.2

632. PROPAGATION OF STRONG SHOCK WAVES IN PULSED LONGITUDINAL MAGNETIC FIELDS. A.C.Kolb.
Phys. Rev., Vol. 107, No. 4, 1197-8 (Aug. 15, 1957).

Describes an experimental arrangement in which a shock-wave plasma is fired into a region over which a strong longitudinal magnetic field is established. The latter field insulates the discharge from the tube walls by "pinching" and accelerates the plasma. Streak-camera photographs are shown. Relative to zero magnetic field, the shock plasma speed is increased almost by x3 and the corresponding Rankine–Hugoniot temperature can be increased from 70 000°K to about 700 000°K. The experiments refer to deuterium gas. J.D.Craggs

X-RAYS

537.531 : 535.33

633. A NEW STUDY OF THE L SPECTRA OF NICKEL AND OF COPPER. Y.Cauchois and C.Bonnelle.
C.R. Acad. Sci. (Paris), Vol. 245, No. 15, 1230-4 (Oct. 7, 1957). In French.

The L spectra of nickel and copper were re-investigated to

redetermine the absorption coefficients near the absorption edges and also the intensity distribution in the emission bands. Special attention was given to the problem of obtaining clean surfaces. The half-width of the L_α band was found to be 2.2 eV for nickel and 3.8 eV for copper. The authors state that their results are not in agreement with those published by Skinner et al. (Abstr. 11103/1954).
T.Mulvey

537.531 : 535.42

634. DIFFRACTION OF SOFT X-RAYS PRODUCED BY TWO SUCCESSIVE CONCAVE GRATINGS. P.Jaeglé.
C.R. Acad. Sci. (Paris), Vol. 245, No. 17, 1412-15 (Oct. 21, 1957). In French.

By using two concave gratings one after the other, it should be possible to improve the resolving power of a spectrometer without increasing the size of the diffraction figure. However the effect of spherical aberration cannot be neglected. The effect of spherical aberration is obtained as a slowly convergent series. This was evaluated numerically for several particular cases by a calculating machine. The results are shown graphically. T.Mulvey

CATHODE RAYS. POSITIVE RAYS

537.533

635. INFORMATION ON A 2.5 MeV MICROTRON.
A.Carrelli and F.Porreca.
Nuovo Cimento, Vol. 6, No. 3, 729-34 (Sept., 1957).

An electron microtron of the a = 3, b = 1 model has been built and its essential parts are described. 10 orbits were obtained and the final energy of the particles is 2.5 MeV. The machine is at present without an extractor and therefore only γ-rays are available. The average intensity on the last orbits is some 10^{-7}A. A.

537.533.3

636. NONLAMINAR FLOW IN CYLINDRICAL ELECTRON BEAMS. K.J.Harker.
J. appl. Phys., Vol. 28, No. 6, 645-50 (June, 1957).

Experimental measurements on the transverse velocity distribution in cylindrically symmetric electron beams emergent from magnetically shielded cathodes are reported. For strong magnetic fields the transverse velocity distribution at the beam centre was found to be composed of discrete classes. These results are explained on the basis of a beam model with nonlaminar flow in which thermal velocities and space charge are neglected. The mechanism depends on the periodic passage of electrons through or very near the beam axis and the fact that the wavelength of this periodicity is a decreasing function of the distance between the point of entry into the magnetic field and the axis. When the space charge and magnetic forces are comparable, no discrete transverse velocity distribution was observed. It is shown, however, that the beam should still be in the same type of nonlaminar flow as above. A.

537.533.3

637. ON THE GEOMETRICALLY ABSOLUTE OPTICAL REPRESENTATION IN THE ELECTRON MICROSCOPE.
R.S.Ingarden.
Prace Wrocław. Tow. nauk B, No. 45, 60 pp.

Electron trajectories can be represented as the geodesics of space concisely described in tensor notation. The normal relativistic ray equations are generalized for Finsler and various derived spaces. "Absolute", "stigmatic", and "perfect" focusing are distinguished. For point-objects, these give respectively a single point-image, many point-images, and a single point-image formed with an aperture of 4π and combined with uniformity of transit time. It is found that (1) "perfect" representation of a three dimensional object (such as would be given by Maxwell's "fish-eye") can never be achieved in an electron microscope (this depends, however, on Blaschke's theorem, generally accepted but not proved), and (2) that "absolute" imaging of a point object can be achieved with electrons in non-static fields, subject to certain relativistic aberrations.
A.E.I. Research Laboratory

537.534

638. THE ABERRATION OF THE TOROIDAL CONDENSER.
H.Ewald and H.Liebl.
Z. Naturforsch., Vol. 12a, No. 1, 28-33 (Jan., 1957). In German.

An extension of a previous first order analysis (Abstr. 1300/1956), of an electrostatic toroidal system for mass spectrometer application. Expressions for the nine aberration constants are derived. The effect of fringing fields is briefly discussed.
E.A.Ash

537.534

639. ON THE POSSIBILITY OF USING A TRAVELLING WAVE TO ACHIEVE FOCUSING IN A LINEAR ACCELERATOR.
V.S.Tkalich.
Zh. éksper. teor. Fiz., Vol. 32, No. 3, 625-6 (1957). In Russian.

A method is suggested where the radial and phase focusing in a linear accelerator may be achieved by using an additional generator instead of a corrugated wave-guide. It is shown that if the parameters defining the additional wave are properly chosen, the focusing conditions coincide with those of a standard linear accelerator.
G.Martelli

537.534.8

640. THE INTERACTION OF IONIC BEAMS WITH SOLID SURFACES. W.J.Moore, C.D.O'Briain and A.Lindner.
Ann. N.Y.Acad. Sci., Vol. 67, 600-18 (May, 1957).

An apparatus was constructed in which the ion beam from a r.f. source is drawn out, magnetically analysed, and focused on a metal target incorporating a radioactive tracer. With this apparatus sputtered metals can be measured with a sensitivity of 0.02 microgram, and the angular distribution of the sputtered material can be determined from the distribution of radioactivity in the collectors. The arrangement permits measurement of absolute sputtering rates, corrected for secondary emission. First results, for Ag with H ions at normal incidence and 9250 V, were (atoms sputtered per incident ion): H^+, 0.025; H_2^+, 0.065; D^+, 0.072. Higher yields reported by earlier workers are believed to be due to their use of an unanalysed beam containing neutral atoms highly effective in sputtering. Author

DISCHARGE TUBES. IONIZATION. THERMIONICS

537.564

641. ON THE DETECTION OF SINGLE ELECTRON AVALANCHES AND THEIR SECONDARY PROCESSES IN GASES.
J.K.Vogel.
Z. Phys., Vol. 148, No. 3, 355-73 (1957). In German.

Continuation of previous work (Abstr. 7138/1957) using the same techniques. The influence of the formation of negative ions on the growth of ionization in O_2 is discussed, and values given for the drift velocity of positive ions in air, N_2 and O_2. Possible explanations of the observed slow development ($\sim 10^{-6}$ sec instead of 10^{-8} sec) of the electron component of avalanches in air and nitrogen are discussed. This slow development accounts for the discrepancy previously noted (Abstr. 9677/1955 and 8430/1953) between observed and calculated formative time lags in air.
J.Dutton

537.583

642. ANALYSIS OF THE D.C. AND PULSED THERMIONIC EMISSION FROM BaO. G.A.Haas.
J. appl. Phys., Vol. 28, No. 12, 1486-92 (Dec., 1957).

The effects of field penetration and donor mobility on the chemical potential of BaO are computed by using a nondegenerate single donor level semiconductor model. Calculations which neglect the effects of surface states and porosity predict that the pulsed emission starts lower, but increases with field more rapidly than given by simple Schottky theory, actually being capable of exceeding the theoretical Schottky emission. The d.c. emission level is always lower than the pulsed emission, the difference being more pronounced at higher fields and for less active cathodes. A.

537.583 : 537.534.9 : 621.385.032.213.13

643. ACTIVATION OF AN OXIDE CATHODE BY DEPOSITION OF ALKALINE EARTH METAL IONS VIA A MASS SPECTROMETER.
R.M.Matheson, L.S.Nergaard and R.H.Plumlee.
R.C.A. Rev., Vol. 18, No. 3, 385-431 (Sept., 1957).

A graphical display is given of thermionic activation effects produced by deposition of mass-spectrometrically resolved ion beams of the alkaline earth metals on an oxide cathode. The maximum ion beam current density deposited was 7×10^{-8} A/cm^2, corresponding to a deposition rate of the order of 0.02 monolayer per minute. Emission activations in excess of two orders of magnitude (referred to the thoroughly deactivated state) were produced. Maximum current densities of approximately 30 mA/cm^2 (corrected to 1000°K) were measured. These experiments, devised to facilitate the simplest and purest study feasible of the kinetic processes of

cathode activation, show that cathode electrical behaviour is dependent in a very complex way on stoichiometry and emission duty. As is to be expected from recent interpretations of cathode chemistry, all the alkaline earth metals produced essentially identical emission activation effects. Emission activation—decay cycles produced by metal depositions vary with cathode temperature, environment, and previous history. Plots of emission versus time during and following depositions at cathode temperatures in the range 765-910°K show some resolution of the rate processes in time and temperature. To describe the gross features of the build-up or recovery branches of these emission cycles analytically, as many as three terms exponential in q (the time-integrated electron charge passed) are required, and one term exponential in time. Series—parallel and opposing rate processes are indicated. A tentative and incomplete physical model of the emission—deposition behaviour is given; however, a satisfactory analysis in terms of a physical-chemical model has not yet been derived. A.

COSMIC RAYS

537.591.1

644. ANOMALOUS HEAVY PRIMARY CASCADES RECORDED ON VIKING 10 ROCKET FLIGHT. H.Yagoda.
Nuovo Cimento, Vol. 6, No. 3, 559-70 (Sept., 1957).

Emulsions flown to 136 miles on Viking-10 surrounded by only 2 $g.cm^{-2}$ of superimposed metallic absorber recorded two examples of heavy primaries which on collision with emulsion nuclei are not destroyed catastrophically. The heavily-charged relativistic fragments emerging from the primary act produce secondary collisions after traversing distances that are small compared with the collision mean free path of the identified nuclei. The first event initiated by a particle of charge 14 ± 1 encompasses a total of 5 collisions which could originate by successive chance deviations from the geometric mean free path with a probability of 1.3×10^{-6}. The second cascade initiated by a carbon nucleus passes through two stages, and has its charge reduced to Z = 3 before the latter escapes from the detector. Considerations of the relative frequency of different modes of fragmentation and geometric escape further reduce the probability of these events originating by chance and being detected. A.

537.591.1 : 523.165

ON THE ORIGINS OF COSMIC RAYS. See Abstr. 486

537.591.15

645. ON THE ANALYSIS OF THE COSMIC RAY JETS.
H.Huzita.
Nuovo Cimento, Vol. 6, No. 4, 841-9 (Oct., 1957).

A new method for analysing cosmic-ray jets is presénted which is independent of the angular fluctuations of secondary particles for each event. Two events are analysed by this method and discussed. A.

537.591.15

646. CONTRIBUTION OF PRIMARY α-PARTICLES TO DEVELOPMENT OF THE NUCLEON CASCADE IN THE STRATOSPHERE. Zh.S.Takibaev and P.A.Usik.
Zh. éksper. teor. Fiz., Vol. 32, No. 4, 924-5 (1957). In Russian.

The contribution of primary α-particles of high energy to transition curves of the nucleonic cascade in air is calculated. The creation of π-mesons and of secondary α-particles as well as ionization losses of charged particles have been neglected in the calculation. Transition curves for the star-generating component, with energy $E \geq 100$ MeV are given in each of the cases where the contribution of primary α-particles is taken into account or neglected. The results are compared with some experimental data obtained in the authors' laboratory. G.Martelli

537.591.2

647. NEUTRON YIELD FUNCTIONS FOR THE NUCLEONIC COMPONENT OF COSMIC RADIATION. R.R.Brown.
Nuovo Cimento, Vol. 6, No. 4, 956-62 (Oct., 1957).

In view of recent proposed changes of cosmic-ray geomagnetic coordinates and primary spectra, calculations have been made to determine if the yield function for the nucleonic component of cosmic radiation introduced by Fonger is in need of revision. As a result of these calculations, a modified form of Fonger's yield-function is proposed for calculations with the revised spectra and coordinate system. The implications of this modification for the spectra of solar flare radiation are considered. A.

537.591.5

648. THE DIFFERENTIAL AND DIRECTIONAL POSITIVE EXCESS OF MESONS AT SEA LEVEL. U.Fasoli, I.Modena, E.Pohl and J.Pohl-Rüling.
Nuovo Cimento, Vol. 6, No. 4, 869-81 (Oct., 1957).

Results are given of a period of observation of the intensity of positive and negative μ-mesons arriving at zenithal angles of 15°, 30°, 45° and 60°. The interpretation of the experimental data which is given here indicates that the E—W symmetry is due solely to the horizontal component of the earth's magnetic field, which introduces a difference in the path length in the atmosphere for the mesons of different sign. Particular consideration in given to the fact that the exponent γ which appears in the meson energy spectrum is dependent on the zenithal angle. A.

537.591.5

649. HIGH-ALTITUDE COSMIC-RAY LATITUDE EFFECT FROM 51° TO 65°N GEOMAGNETIC LATITUDE.
J.R.Winckler and K.A.Anderson.
Phys. Rev., Vol. 108, No. 1, 148-54 (Oct. 1, 1957).

A significant latitude effect of approximately 45% for the total vertical cosmic-ray flux was found over the region 51°N to 65°N at 10 g/cm^2 atmosphere depth in 1955. No evidence for a primary "knee" can be found separated from the air-path saturation effect with latitude. Since there is evidence that the α-spectrum is flat north of 55°, one concludes that the rigidity spectra of primary protons and α's differ over the corresponding rigidity region. Comparison of these data with telescope measurements of Pomerantz and McClure in 1950 does not show the anticorrelation with sunspot numbers found by Neher for ion-chamber measurements. The data are not in disagreement with latitude coordinates 4° higher suggested by studies of α-particles, and, in fact, the observed latitude "saturation" effects are in better agreement with these new coordinates. A greatly increased counting rate was observed both at Minneapolis and Flin Flon, Manitoba, on August 26, 1955 at high altitude. A.

MAGNETISM

538.114 : 538.242

650. EFFECTIVE GYROMAGNETIC RATIO FOR TRIANGULAR FERRIMAGNETIC STATES. A.Eskowitz and R.K.Wangsness.
Phys. Rev., Vol. 107, No. 2, 379-80 (July 15, 1957).

It is shown from the semiclassical equations of motion and the molecular-field approximation that the triangular ferrimagnetic state can also be described by an effective gyromagnetic ratio. This effective ratio depends explicitly on the ratio of the inter- to intra-sublattice molecular field constants rather than on the static sublattice magnetizations as in the antiparallel state. It is estimated that the shift in g-values for $FeCr_2O_4$ should be observable if there is a transition from a triangular to an antiparallel state. A.

538.114 : 537.533.7

651. AN INVESTIGATION INTO THE EFFECT OF MAGNETIC DOMAINS IN COBALT ON AN ELECTRON BEAM.
M.Blackman and E.Grünbaum.
Proc. Roy. Soc. A, Vol. 241, 508-21 (Sept. 10, 1957).

The effect on an electron beam of the leakage field due to the magnetic domains in an unmagnetized crystal of hexagonal cobalt was investigated. A conventional electron-diffraction camera was used, the primary beam being limited,by a small movable aperture and the deflections observed on a photographic plate. Both the hexagonal and prism faces were examined. Magnetic effects were found (a) on the primary beam, (b) on the diffraction pattern, (c) on the shadow edge of the diffraction pattern, and (d) on the shadow photograph of the crystal produced by diffuse scattering from the edge of the aperture. These effects are analyzed in terms of the fields produced by the magnetic domains; measurements are made of the size of the domains and of the magnitude of the leakage field at the surface and its variation with the distance from the surface. A.

538.114

652. ON THE FORMATION OF BITTER FIGURES.
W.H.Bergmann.
Z. angew. Phys., Vol. 8, No. 11, 559-61 (Nov., 1956). In German.

The conditions required for the formation of Bitter figures are discussed and it is shown that the size of the suspended particles must lie between certain limits if the figures are to be formed. It is also shown that the intensity of magnetization of the suspended

particles must not exceed a certain critical value which depends upon the magnetic properties of the material under examination. The results obtained explain why Bitter figures are not formed on strain-free Ni–Fe alloys containing from 50-80% Ni.

A.E.De Barr

538.221/.222

653. MAGNETIC PROPERTIES OF MANGANESE OXIDES AT TEMPERATURES FROM 20 TO 300°K.
A.S.Borovik-Romanov and M.P.Orlova.
Zh. éksper. teor. Fiz., Vol. 32, No. 5, 1255-6 (1957). In Russian.

The susceptibility χ of natural samples of Mn_2O_3 and Mn_3O_4 was measured. The former showed ferromagnetic behaviour (saturation and hysteresis) below 42.5°K and a $1/\chi$–T curve at higher T in rough agreement with Néel's formula for a ferrimagnetic. The latter remains paramagnetic over the whole range but the $1/\chi$–T curve is anomalous, possibly due to impurities.

D.Shoenberg

538.221

654. MAGNETIC ALIGNMENT OF SINGLE IRON PARTICLES.
J H.L.Watson.
J. appl. Phys., Vol. 28, No. 7, 821-2 (July, 1957).

Reports results of electron microscopical investigations on iron particles about 1 μ long and 0.05 μ thick suspended in a polymerizing monomer to a density about 1% and oriented in fields up to 2.5×10^4 oersted. The degree of alignment of the particles was found to be poor due to the formation of particle arrays (chains, rings) which reduces their magnetostatic energy. E.P.Wohlfarth

538.221

655. APPLICATION OF THE ISING–BETHE THEORY TO THE SUSCEPTIBILITIES OF THE POLYMORPHIC FORMS OF MnS.
P.J.Wojtowicz.
Phys. Rev., Vol. 107, No. 2, 429-30 (July 15, 1957).

With the aid of the Ising–Bethe theory it has been shown that the susceptibilities of the three polymorphic forms of MnS can be correlated with the same indirect exchange mechanism as that required to explain the observed magnetic structures. It has also been possible to obtain certain semiquantitative information concerning the Mn–S–Mn indirect exchange interaction. In view of the results reported in this paper, it is recommended that greater use be made of the Ising–Bethe or Bethe–Weiss–Li theories in the interpretation of susceptibility data obtained at temperatures not too far above the Néel temperature. A.

538.221

656. OBSERVATION OF NUCLEAR MAGNETIC RESONANCE IN ANTIFERROMAGNETIC $Mn(F^{19})_2$.
V.Jaccarino and R.G.Shulman.
Phys. Rev., Vol. 107, No. 4, 1196-7 (Aug. 15, 1957).

Resonance of the F^{19} nucleus was observed at frequencies in the range 152-168 Mc/s, external fields of 300-3000 Oe and temperatures between 1.3°K and 20.4°K. The resonances were Gaussian with widths ~14 Oe and the spin–lattice relaxation time was estimated to be ~20 sec at 4.2°K. Measurements of the resonance frequencies yielded the sublattice magnetization which was found to obey a $T^{2.5}$ law, at the lowest temperatures. Values of the hyperfine interaction constants were deduced from the spatial dependence of the field for resonance at fixed frequency.

D.J.Oliver

538.23

657. A RELATION BETWEEN HYSTERESIS CONSTANT AND COERCIVE FORCE. M.Kornetzki.
Z. angew. Phys., Vol. 8, No. 11, 536-8 (Nov., 1956). In German.

Although the permeability of many magnetic materials at low field strengths increases linearly with the field strength (Rayleigh law), in many other cases the permeability appears to increase linearly with the induction giving a hyperbolic magnetization curve in this region. If the asymptote of this curve is taken as the coercive force a relation can be found between the Jordan hysteresis constant h and the coercive force such that $hH_C = 4$. This is in good agreement with the observed mean value of this product. The theoretical interpretation of this result is discussed. A.E.De Barr

538.23

658. HYSTERESIS-RELAXATION AND PERMEABILITY OF SILICON-IRON CONTAINING CARBON. F.Schreiber.
Z. angew. Phys., Vol. 8, No. 11, 539-51 (Nov., 1956). In German.

A detailed treatment, in terms of Preisach diagrams, of hysteresis-relaxation phenomena at low field-strengths. The quantities considered are the shape of the hysteresis loop, the harmonic content of the induction, and the permeability, and these are discussed in relation to the movement of carbon atoms and to Barkhausen jumps of Bloch walls. The quantitative relations between the variations in shape of the hysteresis loop and those of the real and imaginary parts of the permeability are treated with the help of a Fourier analysis. As a measure of the hysteresis-relaxation a "creep permeability" is introduced. This is the product of two factors — a hysteresis constant and a limiting field strength — which are proportional to the carbon content of the material and which can be determined experimentally.

A.E.De Barr

ELECTROMAGNETISM. ELECTRODYNAMICS

538.3 : 621.3.013

659. ELECTROMAGNETIC ENERGY TRANSFER. P.Hammond.
Proc. Instn Elect. Engrs, Monogr. 286, publ. Feb., 1958, 7 pp.
To be republished in Part C.

Methods of calculating and measuring the flow of electromagnetic energy are compared and contrasted. The differences between the low-frequency and high-frequency approaches to energy flow problems are discussed and suggestions are made to ease the difficulties in the way of students and teachers faced with these apparently irreconcilable differences. A.

538.3

660. ON THE RADIATION OF A POINT CHARGE MOVING UNIFORMLY ALONG THE SURFACE OF AN ISOTROPIC MEDIUM.
A.I.Morozov.
Zh. éksper. teor. Fiz., Vol. 32, No. 5, 1260-1 (1957). In Russian.

Formulae for a non-dispersive medium are used to obtain the Cherenkov radiation of and force on the particle. These are compared with results for a filament, obtained by the author earlier.

G.E.Brown

ELECTROMAGNETIC WAVES AND OSCILLATORS

538.561 : 621.373

661. COMMENTS ON FREQUENCY-PULLING OF MASER OSCILLATORS. C.H.Townes.
J. appl. Phys., Vol. 28, No. 8, 920-1 (Aug., 1957).

In a beam-type maser oscillator the cavity tuning "pulls" the oscillation frequency from the resonance frequency v_0 of the molecules by an amount $(v-v_0) \propto f(n)$ which is of the order of unity, where n is the number of molecules entering the cavity per sec. For a Maxwellian distribution of velocities, Helmer and Lamb (Stanford Univ. Microwave Lab. Tech. Rep. No. ML-311, 1956) showed that $(v-v_0)$ increases initially as n increases, but Helmer's experimental results (Abstr. 5485/1957) do not confirm this. The author briefly discusses the physical origin of the increase in $(v-v_0)$ and indicates a possible reason for its non-observance. S.Weintroub

538.561 : 621.373

662. MASER NOISE MEASUREMENT. J.C.Helmer.
Phys. Rev., Vol. 107, No. 3, 902-3 (Aug. 1, 1957).

Using an ammonia beam oscillator as primary frequency standard the average noise figure of an ammonia beam maser amplifier is found to be 3.52 ± 0.5 dB agreeing with theory assuming a noiseless beam. J.W.Sturgess

538.566 : 621.371

663. DIFFRACTION BY CYLINDRICAL REFLECTORS.
R.Plonsey.
Proc. Instn Elect. Engrs, Monogr. 281R, publ. Jan., 1958, 7 pp.
To be republished in Part C.

The electromagnetic diffraction problem is formulated in terms of the determination of the currents induced on a reflector-scatterer by a primary source. All field quantities are readily determined therefrom. An approximate solution ignores the interaction of currents on the reflector-scatterer in that it relates the surface current to the incident magnetic field. This is the geometrical-optics current. For the strip and circular reflector with line source at its centre, corrections to the geometrical-optics currents are obtained by an approximate analytic technique. In each case this yields an equivalent line current at the edges. The field of the line current is non-isotropic; its directional gain is determined by

appealing to the Sommerfeld half-plane solution. The line currents do not greatly affect the total pattern; this indicates that the main character of the diffraction can be obtained from the geometrical-optics currents. Measurements of the diffracted field of a circular cylindrical reflector with line feed at its centre were made in a parallel-plane device. A description of some of the features of the equipment is given. The results confirm that geometrical-optics currents are themselves satisfactory, but are inconclusive with respect to the correction line currents. A.

538.566.3 : 621.396.812

664. ON THE SCATTERING OF VERY HIGH FREQUENCY RADIO WAVES IN THE IONOSPHERE. T.V.Ionescu.
C.R. Acad. Sci. (Paris), Vol. 245, No. 5, 520-2 (July 29, 1957). In French.

A theory is advanced that the scattering of v.h.f. radio waves (> 25 Mc/s) in the region below the ionosphere can be accounted for in terms of the influence of negative ions of molecular oxygen. Experiments have shown that at low pressures under the influence of a high-frequency electric field, O_2^- and H_2^- ions have natural frequencies of vibration, and an expression involving such natural frequencies is given for the power scattered by 1 cm^3 of ionosphere crossing unit area normally to the direction of propagation at a given distance. The numerical results agree reasonably well with the experimental measurements of Bailey, Bateman and Kirby (Abstr. 853B/1956, Proc. Inst Radio Engrs, Vol. 43, No. 10, 1181-230(Oct., 1955). G.M.Brown

538.566.3 : 621.396.8

665. THE OCCULTATION OF PATHS: AN IMPORTANT PHENOMENON IN IONOSPHERIC PROPAGATION. K.Rawer.
Nuovo Cimento Suppl. (Ser. 10), Vol. 4, No. 4, 1460-77 (1956). In French.

Various cases are considered of the masking of ionospheric reflections from higher layers following reflection from lower layers. The latter may be thin (Es) or thick (E), and consideration is given to these in relation to the parameters fEs, fbEs and fE, for vertical and oblique incidence. Some interesting phenomena observed on certain radio links are described, and practical applications for ionospheric propagation to very great distances are considered. G.M.Brown

538.566.3 : 551.510.535

666. ON THE ABSORPTION OF SHORT WAVES IN AN ISOTROPIC IONIZED LAYER. E.Argence.
Nuovo Cimento Suppl. (Ser. 10), Vol. 4, No. 4, 1478-510 (1956). In French.

Following a definition of an isotropic ionized layer, a detailed mathematical study is made of its properties in relation to the trajectories of an e.m. wave. The equivalence theorem of Martyn remains valid under certain conditions, while other equivalance theorems may be formulated. Separate numerical methods are developed for the calculation of the deviative absorption at normal incidence in an isothermal and in a non-isothermal atmosphere (linear temperature gradient). G.M.Brown

538.567 : 535.56

667. MAGNETO-OPTICAL PHENOMENA IN THE RADIO-FREQUENCY RANGE. A.Gozzini.
Cahiers de Phys., Vol. 11, 123-35 (March, 1957). In French.

A review is given of the work since 1948 on the Faraday and Cotton–Mouton effects in solids, as observed in the radiofrequency range in association with paramagnetic or ferromagnetic resonance. The theories for these effects are briefly mentioned, and the experimental techniques for their observation described. B.T.M.Willis

NUCLEAR AND ATOMIC PHYSICS

APPARATUS. PARTICLE DETECTORS

539.1.07

668. COUNTING RATE CURVES FOR GEIGER COUNTERS AND THEIR GEOMETRY. P.J.Grouse and H.D.Rathgeber.
Nuovo Cimento, Vol. 6, No. 3, 719-22 (Sept., 1957).

The shape of the counting-rate curve for a particular type of Geiger counter is computed from purely geometrical considerations. Experiments designed to minimize non-geometrical effects support these calculations. General observations are made concerning the effect of design parameters upon counting curves for counters of all designs. A.

539.1.07

669. BORON TRIFLUORIDE PROPORTIONAL COUNTERS. W.Abson, P.G.Salmon and S.Pyrah.
Proc. Instn Elect. Engrs, Paper 2542M, publ. Jan., 1958, 9 pp. To be republished in Vol. 105B (1958).

The design and manufacture of a variety of types of boron-trifluoride proportional counter used by the U.K.A.E.A. are described. One basic design and method of assembly is used for the manufacture of counters of sizes ranging from $\frac{1}{2}$ in. diameter and a few inches long to 2 in. diameter and several feet long. The technique of manufacture is suitable for large-scale production, and consistently good electrical characteristics can be obtained. Details are given of the operating characteristics of a wide range of counters, and the effect of circuit parameters on the output pulse amplitude is discussed. Measurements of the γ-response of medium-size counters show that they can be used to discriminate between neutrons and γ-radiation at γ dose-rates of 100-200 rad/hr. The counters can be used for long periods at temperatures up to 100°C without significant deterioration in characteristics. The counting life is found to be a function of counter size and of gas multiplication, and is probably limited by dissociation of BF_3 and the formation of electron-capturing dissociation products. A typical medium-size counter, e.g. 1 in. diameter by 6 in. long, can be used for 10^{11} counts at a gas-multiplication factor, M, of 10, before significant deterioration of the counting characteristics occurs. Some applications of BF_3 proportional counters, such as in reactor instrumentation, and the use of large counter arrays in nuclear physics experiments, are discussed briefly. A.

539.1.07

670. THE DESIGN, PERFORMANCE AND USE OF FISSION COUNTERS. W.Abson, P.G.Salmon and S.Pyrah.
Proc. Instn Elect. Engrs, Paper 2546M, publ. Jan., 1958, 8 pp. To be republished in Vol. 105B (1958).

The basic design criteria for electron-collection (ionization chamber) fission counters are discussed; data are presented concerning the effect of thickness of fissile material on sensitivity and the effect of electrode spacing and gas pressure on pulse height. High detection efficiencies are obtained with electrode coatings of 1 mg/cm^2, and thicknesses up to 2 mg/cm^2 may be used when high sensitivities are required. When argon is used as the filling gas the product of gas pressure and electrode spacing (pd, in atmosphere.cm) should lie in the region 0.4-1.0, the higher value being preferable if it does not give rise to difficulties in ionization collection. The operating level of the discriminator bias is usually determined by the effect of α-activity in the fissile material. Typical values of the operating bias level at which a high detection efficiency is possible correspond to 5-20 MeV particle energy. The designs of several types of fission counter are described, illustrating experimental applications and the use of this type of detector in reactor instrumentation systems. A.

539.1.07

671. LIQUID SCINTILLATORS IN FILTER PAPER — A NEW DETECTOR. J.C.Roucayol, E.Oberhauser and R.Schussler.
Nucleonics, Vol. 15, No. 11, 104, 106, 108 (Nov., 1957).

Soft β-emitters absorbed on filter paper were counted by dipping the paper in a liquid scintillator and pressing it on the cathode of a photomultiplier. Efficiency of detection is high and the technique is simple and reliable. R.D.Smith

539.1.07

672. CORRELATION OF GAS BUBBLE CHAMBER RESULTS WITH GLASER'S THEORY. C.Henderson and G.Kalmus.
Nuovo Cimento, Vol. 6, No. 4, 925-6 (Oct., 1957).

The boundaries of the sensitive region of a methane–propane gas bubble chamber are shown to approximate to lines of constant n, in the case of this chamber n = 2 and n = 6, where n is the parameter defined by Glaser's equation. A.

539.1.07

673. THE FADING OF α-TRACKS IN ILFORD C2 PLATES. S.Deutsch and E.Picciotto.
Nuovo Cimento, Vol. 6, No. 4, 953-5 (Oct., 1957). In French.

After irradiation by an alpha source, the photographic plates were stored in air, at various temperatures for a period of four months. They were then compared with a standard plate which had been developed immediately after irradiation. Amongst the plates stored at −35°C no particle track fading was noticed, neither was a diminution in the number of tracks. Amongst those plates stored at 4°C and at 15°C, the grain density of the particle tracks had lessened and respective percentage losses of 38% and 72% in the number of tracks were noticed. A.

539.1.07 : 621.383.27

674. ALL-TRANSISTOR CIRCUITS FOR PORTABLE DETECTORS. G.G.Eichholz, G.E.Alexander and A.H.Bettens.
Nucleonics, Vol. 15, No. 11, 90-3 (Nov., 1957).

Circuits for the operation of G.M. counters and photomultipliers are described. R.D.Smith

539.1.07

675. HIGH SENSITIVITY TRANSISTOR PULSE TRIGGER CIRCUIT. E.Zaglio.
Nuovo Cimento, Vol. 6, No. 3, 512-15 (Sept., 1957).

A high-sensitivity current pulse discriminator is described. It is obtained by using a germanium diode and a differential negative resistance of high stability consisting of a transistor amplifier with a positive feedback. The threshold can be set in the range of 5 to 50 μA, its stability being of the order of 1%. A.

ELEMENTARY PARTICLES

539.12

676. THE PARITY OF ELEMENTARY PARTICLES. P.T.Matthews.
Nuovo Cimento, Vol. 6, No. 3, 642-9 (Sept., 1957).

In determining the intrinsic parities of elementary particles, the invariance of the interactions under gauge transformations makes the relative parity of certain groups of particles a matter of convention. On the other hand, charge independence puts definite restrictions on the relative parities of the members of isotopic multiplets. The interplay of these conventions and restrictions is analysed and the general considerations applied to the known particles. A.

539.12 : 530.145

TWO POSSIBLE SCHEMES OF NON-CONSERVATION OF PARITY IN WEAK INTERACTIONS. See Abstr. 496

539.12 : 530.145

THEORY OF THE FERMI INTERACTION. See Abstr. 507

539.12

677. CONCERNING THE ELASTIC SCATTERING OF HIGH ENERGY PARTICLES. I.M.Khalatnikov.
Nuclear Physics, Vol. 3, No. 3, 433-5 (May, 1957).

Large and small angle formulae for the scattering amplitude derived by Schiff (Abstr. 6364/1956) do not go over into each other. It is pointed out that this is due to an error in Schiff's calculation of the large angle case, and a corrected formula is derived. N.M.King

539.12 : 530.145

GREEN'S FUNCTION FOR A PHOTON, ACCURATE TO e^4. See Abstr. 511

539.12

678. THE COHERENT SCATTERING OF γ-RAYS BY K ELECTRONS IN HEAVY ATOMS. IV. THE SCATTERING OF 1.28 AND 2.56mc^2 γ-RAYS IN MERCURY.
G.E.Brown and D.F.Mayers.
Proc. Roy. Soc. A, Vol. 242, 89-95 (Oct. 15, 1957).

For Pt III see Abstr. 4621 (1956). The results of calculations for the coherent scattering of γ-rays of energies 1.28 and 2.56mc^2 are given in the form of scattering amplitudes as functions of angle. Cross-sections computed from these are compared with the experimental data for scattering by lead, and the evidence for Delbrück scattering is discussed. A.

539.12

679. CIRCULAR POLARIZATION DETECTION OF GAMMA RAYS. D.B.Beard and M.E.Rose.
Phys. Rev., Vol. 108, No. 1, 164-5 (Oct. 1, 1957).

A method is proposed for detecting circular polarization by observing the azimuthal asymmetry in the intensity of γ-rays scattered by electrons polarized transversely to the direction of propagation. It is shown that this method can lead to larger anisotropies than are observed in transmission experiments with longitudinally polarized electrons. M.A.Grace

539.12

680. ON POLARIZATION EFFECTS IN COULOMB ELECTRON SCATTERING. G.Passatore.
Nuovo Cimento, Vol. 6, No. 4, 850-63 (Oct., 1957).

Polarization effects in Coulomb electron scattering are considered by using Stokes parameters technique. As four real parameters completely describe the intensity and the polarization of a beam, the transition probability is expressed by a T-matrix which operates on them and the general relation expressing the T-matrix in terms of the S-scattering matrix is then deduced. The T-matrix connecting the Stokes parameters of the scattered beam with those of the incident one is obtained in Born's first approximation. As is well known, in this approximation there are no polarizing effects, but it becomes easy to discuss explicitly the spin direction dependence on the scattering angle. The T-matrix expression for a general spherical field is then obtained without using Born approximation, and some general features, and in particular the polarizing effect, are discussed. A.

539.12 : 539.166.835

681. ANNIHILATION OF POSITRONS IN GASES.
M.Heinberg and L.A.Page.
Phys. Rev., Vol. 107, No. 6, 1589-600 (Sept. 15, 1957).

The angular correlation of the two-photon annihilation of positrons annihilating in gases at high pressures demonstrates the two modes of decay — (1) from a bound state, positronium, and (2) from an unbound state — in all gases tested that have low-lying energy states. The increase in the narrow component in argon, plus suitable thermalizing gases, due to the application of a d.c. magnetic field obeys the theoretical increase due to the mixing of the $1\ ^1S$ and $1\ ^3S$ m = 0 states. The increase in positronium formation due to the application of a d.c. electric field is observed. Preliminary evidence for the existence of n = 2 states of positronium is seen. A.

539.12

682. LONG LIFETIME OF POSITRONIUM IN LIQUID HELIUM.
R.A.Ferrell.
Phys. Rev., Vol. 108, No. 2, 167-8 (Oct. 15, 1957).

The long orthopositronium lifetime observed by Paul and Graham and Wackerle and Stump (Abstr. 5604-5/1957) in liquid helium is evidence of a pickoff annihilation rate smaller by more than one order of magnitude than the rate to be expected on the basis of the average electron density. This discrepancy is removed by taking into account the repulsive positronium—helium exchange force already derived in previous work. By repelling the helium atoms and creating a cavity, or bubble, in the liquid, a positronium atom is able to avoid contact with the liquid and thereby greatly increase its lifetime. The small pickoff rate observed is attributed to the saturated vapour in the bubble. The repulsive exchange force further decreases this rate, and good agreement is obtained with experiment. It is predicted that increasing the temperature one degree Kelvin, from the boiling point, will decrease the lifetime by a factor of three. Positron lifetime measurements in helium gas at liquid-nitrogen temperature and 0-100 atm pressure would also provide a check on the theory. A.

539.12

683. ANOMALOUS MAGNETIC MOMENT OF THE NUCLEON.
S.Okubo.
Nuovo Cimento, Vol. 6, No. 3, 542-58 (Sept., 1957).

Miyazawa's method of calculation of the anomalous magnetic moment of the nucleon is given a covarient extension by using covariant dispersion relations. In this connection, some attention is paid to the difference between covariant and non-covariant definitions of the magnetic moment from meson current contribution. A.

539.12 : 530.145

THE ANOMALOUS MOMENTS OF NUCLEONS. See Abstr. 502

539.12 : 539.172.13

REACTIONS CATALYSED BY μ-MESONS IN HYDROGEN. See Abstr. 334

539.12

684. USE OF THE CORRELATION OF POLARIZATION IN THE PHASE [SHIFT] ANALYSIS OF p–p SCATTERING. A.G.Zimin.
Zh. éksper. teor. Fiz., Vol. 32, No. 5, 1239-40 (1957). In Russian.

Correlation coefficients are calculated as a function of centre-of-mass angle for the five sets of Berkeley p–p phase shifts at 310 MeV. W.O.Lock

539.12

685. RELATIVISTIC CORRECTIONS TO THE POLARIZATION OF PROTONS AT HIGH ENERGIES. S.Ohnuma.
Phys. Rev., Vol. 108, No. 2, 460-2 (Oct. 15, 1957).

Relativistic corrections to high-energy p–p polarization data are calculated, with a breakdown of contributions into parts corresponding to the anomalous proton magnetic moment and remaining effects. It is found that as much as 70% of the relativistic correction may be caused by the amomalous part of the proton moment. In view of the presence of wave-function distortion effects and the difference in sensitivity of different parts of the correction to the appreciable wave-function distortion effects pointed out by Breit

(Abstr. 5405/1957) it is concluded that the values of the relativistic corrections to polarization are at present quite unreliable. On the other hand, the corrections are smaller than the experimental error in many cases and their unreliability does not appear to affect existing fits to data seriously. A.

539.12

686. THE LOW ENERGY ELASTIC SCATTERING OF NEUTRONS BY DEUTERONS. P.G.Burke and H.H.Robertson.
Proc. Phys. Soc. A, Vol. 70, Pt 11, 777-92 (Nov., 1957).

The elastic scattering of neutrons by deuterons at energies less than 16.6 MeV incident neutron energy has been calculated using a scattering equation similar to that of Buckingham and Massey and a central nuclear potential with Gaussian form. Five values of the effective range are considered, covering all values of physical significance. For analytical convenience, a deuteron wave-function consisting of two Gaussians is used, the deuteron binding energy being minimized with respect to three parameters. S- and P-phases for several energies were evaluated with the aid of electronic computers (Pilot ACE and DEUCE) for Serber, ordinary and symmetrical exchange forces. From the total cross-section below 2 MeV it appears that the potentials of larger effective range agree best with experiment, although the doublet scattering length considerably exceeds the experimentally estimated value for all these potentials, probably because of polarization effects at low energies. From the P-phases, conclusions are drawn about the validity of the Born approximation used by Christian and Gammel. The problem is then resolved for the short-range potential using an adaptation of the variational methods of Hulthén and Kohn. The results at low energies compare favourably with the exact solution obtained previously. It therefore seems that the variational method may be used successfully when polarization of the deuteron is explicitly allowed for, and further calculations including this effect and using the Kohn method are in progress. A.

539.12

687. ON THE SECOND APPROXIMATION IN THE PROBLEM OF DIFFUSION OF SLOW NEUTRONS BY BOUND PROTONS. A.S.Davýdov and D.M.Mel'nichenko.
Zh. éksper. teor. Fiz., Vol. 32, No. 4, 941-3 (1957). In Russian.

It is shown that the second approximation of the Schwinger and Lippmann theory gives divergent results for the diffusion of neutrons on harmonically bound protons. On the other hand the second approximation gives always finite results if the wave-function of real molecules are used. It is pointed out that in a previous paper on the subject by Ekstein (Abstr. 7576/1952) a mathematical error is present. G.Martelli

539.12

688. SLOWING DOWN OF NEUTRONS IN INFINITE HOMOGENEOUS MEDIA. N.Corngold.
Proc. Phys. Soc. A, Vol. 70, Pt 11, 793-801 (Nov., 1957).

A new integral equation governing the slowing down of neutrons in a homogeneous mixture of atoms was derived from the Boltzmann equation. The new equation reflects a view of the neutrons as propagating down the energy scale, whereas the Boltzmann equation expresses a collision balance. Unlike the Boltzmann equation the new equation lends itself to approximate solution by iteration and to the construction of an accurate variational principle for p, the resonance escape probability. Some numerical results are given. A.

539.12

689. SYMMETRY OPERATIONS OF THE HILBERT SPACE AND SELECTION RULES CONCERNING THE INTERACTIONS OF BARYONS AND MESONS. G.Marx and G.Györgyi.
Nuovo Cimento Suppl. (Ser. 10), Vol. 5, No. 1, 159-81 (1957).

Using the theory of Gell-Mann and of d'Espagnat and Prentki, applications of charge conjugation and symmetry properties in the isotopic space yield selection rules for the annihilation of antiprotons and nucleons and relations between the cross-sections of processes in which K-mesons, hyperons and antihyperons are involved. W.A.Hepner

539.12

690. ASYMMETRY OF LOW-ENERGY POSITRONS FROM MUON DECAY. I.A.Pless, A.E.Brenner, R.W.Williams, R.Bizzarri, R.H.Hildebrand, R.H.Milburn, A.M.Shapiro, K.Strauch, J.C.Street and L.A.Young.
Phys. Rev., Vol. 108, No. 1, 159-60 (Oct. 1, 1957).

993 stopping positrons, from the $\pi \rightarrow \mu \rightarrow e$ decay of 82 MeV positive pions, were found in a magnetically-shielded propane bubble-chamber. The asymmetry coefficient is -0.02 ± 0.06 compared with -0.18 ± 0.05 for 1137 positrons of all energies. The two-component theory predicts $+0.05 \pm 0.02$ under the conditions of the experiment. K.H.Barker

539.12

691. PHENOMENOLOGICAL ANALYSIS OF μ DECAY. S.Bludman and A.Klein.
Phys. Rev., Vol. 109, No. 2, 550-3 (Jan. 15, 1958).

The spectrum, asymmetry, and helicity of the electrons from μ decay are calculated from the most general form of the two-component neutrino theory with lepton conservation. In addition to the non-local interactions considered recently by Lee and Yang, terms appearing phenomenologically as derivative couplings may occur. In particular, a spectrum that is, aside from a statistical factor, linear in momentum is possible with $\rho \neq \frac{3}{4}$. This could be interpreted as evidence that fermions of baryonic mass are responsible for the nonlocality. A.

539.12

692. ANGULAR DISTRIBUTION OF NEUTRONS FROM μ^- ABSORPTION IN NUCLEI. H.Überall.
Nuovo Cimento, Vol. 6, No. 3, 533-41 (Sept., 1957).

A general parity-non-conserving absorption process of partly polarized μ^--mesons by protons in a nucleus is considered. The Fermi-gas model is used to estimate the effect of the motion of the protons inside the nucleus on the anisotropy of the emitted neutrons. It is found that the anisotropy of the neutron distribution in the fundamental interaction is mostly preserved, especially towards the upper end of the neutron spectrum: thus an experiment to observe the neutron asymmetry seems feasible. A.

539.12

693. RE-ESTABLISHMENT OF μ^+ POLARIZATION IN DEPOLARIZING MEDIA BY AN EXTERNAL MAGNETIC FIELD. J.C.Sens, R.A.Swanson, V.L.Telegdi and D.D.Yovanovitch.
Phys. Rev., Vol. 107, No. 5, 1465-7 (Sept. 1, 1957).

The $\mu \rightarrow e$ decay asymmetry was investigated as a function of the strength of a longitudinal external magnetic field for nuclear emulsion and fused SiO_2. For the maximum field of 7000 gauss, 70% of the asymmetry was restored. Analysis of the variations suggests that depolarization is due to successive capture and loss of electrons (~ 10) by the muons. There are difficulties in this explanation. K.H.Barker

539.12

694. THE $\pi-\mu-e$ ASYMMETRY. D.H.Wilkinson.
Nuovo Cimento, Vol. 6, No. 3, 516-21 (Sept., 1957).

By comparing the apparent asymmetry of the $\mu-e$ decay observed for μ-mesons stopping in Ilford G5 nuclear emulsion in cyclotron experiments with that for "non-quenching" substances such as graphite it is possible to measure $\gamma G5$, the probability that the μ-meson forgets its orientation on stopping in nuclear emulsion. This determination is independent of the degree of polarization of the μ-meson beam. This result may then be combined with the apparent asymmetry $1 + A \cos\theta$ directly observed for $\pi-\mu-e$ events in nuclear emulsion to find the true asymmetry $1 + \alpha \cos\theta$ for the fundamental $\pi-\mu-e$ process for all electrons observed without energy discrimination. A combination of results from the Columbia and Chicago cyclotron groups gives $\gamma G5 = 0.55 \pm 0.03$. A combination of results from eight groups of emulsion workers gives $A = -0.129 \pm 0.015$. These yield $\alpha = -0.287 \pm 0.039$ which corresponds to the value of the parameter of the two-component neutrino theory $\xi = 0.87 \pm 0.12$. A.

539.12

695. DECAY OF THE NEUTRAL π MESON. J.Bernstein and K.A.Johnson.
Phys. Rev., Vol. 109, No. 1, 189-92 (Jan. 1, 1958).

The possibilities of detecting the parity of the π^0 meson by electromagnetic experiments involving the decay γ-rays are discussed. It is shown that no experiment can be performed which distinguishes scalar and pseudoscalar decays unless azimuthal angular correlations are measured, assuming that the π^0 decays at rest. As an example, the total coincidence Compton scattering cross-section from polarized electron targets is calculated explicitly and shown to be identical for the scalar, pseudoscalar, and parity-nonconserving decay. A.

539.12

696. EXAMPLES OF K-MESON PRODUCTION IN 3 GeV π^--COLLISIONS. T.Bowen, D.M.Haskin and M.Schein.
Nuovo Cimento, Vol. 6, No. 3, 592-600 (Sept., 1957).

The production of K-mesons by 3 GeV π^--mesons was studied

in an emulsion stack by area scanning for stopped K-mesons and tracing to the originating interactions. Two examples of K-meson production are described which can be analysed as due to pion—nucleon collisions. In one event a K^--meson is produced as the only charged particle. In the other event, a K^+-meson and a minimum ionization track are the only secondaries. This event can best be interpreted according to the scheme $\pi^- + p \rightarrow K^+ + \Sigma^0 + \pi^-$ assuming the collision to be with a free proton. Both of the events can be interpreted consistently with the Gell-Mann—Pais scheme. A.

539.12

697. π^-—PROTON INTERACTIONS AT 5 BeV. G.Maenchen, W.B.Fowler, W.M.Powell and R.W.Wright. Phys. Rev., Vol. 108, No. 3, 850-64 (Nov. 1, 1957).

The interaction of 5 BeV negative pions with protons was studied by exposing a 36 atm hydrogen-filled diffusion cloud-chamber to π^- beams. One hundred and thirty-seven interactions producing charged outgoing particles were observed. Of these, 27 were elastic scattering events, 64 were inelastic collisions having two charged outgoing prongs, 39 had four prongs, 3 had six prongs, and 4 involved the production and visible decay of heavy unstable particles. The total cross-section is estimated to be 22.5 ± 2.4 mb. The elastic scattering cross-section is 4.7 ± 1.0 mb. The angular distribution of the elastic events is consistent with that expected for diffraction scattering from a sphere with radius $(0.9 \pm 0.15) \times 10^{-13}$ cm and opacity 0.6. Analysis of the inelastic events shows that multiple, rather than single, pion production is the predominant process occurring at this energy. An average of 2.3 secondary pions were produced in the inelastic events. This average multiplicity can be fitted by the Fermi statistical theory only by increasing the interaction radius occurring in the theory by 20%. The statistical theory, however, fails to account for the rather marked asymmetry found in the c.m. angular distributions of some of the particles emitted in inelastic events. A combination of the four observed strange-particle production events with 11 similar events obtained in exposures to high-energy neutron and proton beams shows that pion emission accompanies strange-particle production in at least 60% of elementary-particle collisions at Bevatron energies. A.

539.12

698. π^-—NUCLEON INTERACTIONS AT 4.5 BeV. W.D.Walker. Phys. Rev., Vol. 108, No. 3, 872-7 (Nov. 1. 1957).

An emulsion study was made of π^-—nucleon interactions at a pion energy of 4.5 BeV. The percentage of elastic scattering at this energy seems slightly smaller than at energies slightly above 1.0 BeV. It can be deduced from this that the range of interaction between π^- and proton is greater than 1.0×10^{-13} cm. The inelastic interactions resulting in two prongs are considered in some detail. The angular distributions are suggestive of a direct knock-out of a pion by the incoming pion. The momentum distributions obtained recently from diffusion chamber work also seem to support such a model. The four- and six-prong events are more complicated. The data from all inelastic interactions indicate the nucleons seem to go strongly in the backward direction in the c.m. system. Thus none of the interactions seem consistent with the statistical model of pion production. A.

539.12

699. STRANGE-PARTICLE EFFECTS IN S-WAVE PION—NUCLEON SCATTERING. J.S.Langer. Nuovo Cimento, Vol. 6, No. 3, 674-82 (Sept., 1957).

An attempt is made to explain the isotopic-spin splitting of the S-wave phase-shifts in pion—nucleon scattering in terms of virtual strange-particle effects. A very simple calculation is found to agree quite well with experiment. A.

539.12 : 530.145

700. APPROXIMATE METHODS IN S WAVE PION NUCLEON SCATTERING. B.H.Bransden and R.G.Moorhouse. Nuovo Cimento, Vol. 6, No. 3, 693-700 (Sept., 1957).

The reliability of the Tamm—Dancoff and Cini—Fubini methods for S-wave pion scattering is examined by applying these approximations to an example for which the exact solution is known. It is shown that under certain conditions the Tamm—Dancoff method in its lowest orders is quite accurate, the Cini—Fubini method being unreliable. A.

539.12

701. PAIR PRODUCTION OF POSITIVE MESONS BY ONE MESON. R.Omnes. Nuovo Cimento, Vol. 6, No. 4, 780-95 (Oct., 1957). In French.

A system of generalized Low equations on the model of Chew is established. The cross-section for production of two positive π-mesons in a P-state is deduced by a one-meson approximation. The corresponding integral equation is numerically solved by using the experimental phase-shifts and the invalidity of an iteration solution is showed. A.

539.12

702. SMALL-ANGLE PHOTOPRODUCTION OF POSITIVE PIONS FROM HYDROGEN. J.H.Malmberg and C.S.Robinson. Phys. Rev., Vol. 109, No. 1, 158-65 (Jan. 1, 1958).

The angular distribution of π^+ mesons produced in hydrogen by 225 MeV photons was measured in the small-angle region. The mesons were produced in a liquid hydrogen target placed in the X-ray beam of the 300 MeV betatron. A focusing magnet was used to select mesons of the desired momentum. The large electron-pair background was avoided by use of a very short X-ray pulse and a counter system which operated only after the pulse, counting the decays of μ^+ mesons. Points were obtained at centre-of-mass angles of 10, 15, 20, 30, 45, 60, and 90 degrees. The observed angular distribution cannot be fitted by a quadratic in $\cos\theta^*$, but is well fitted by the cross-section calculated from the field theory of Chew, Goldberger, Low, and Nambu. A.

539.12

703. THE RELATIVE FREQUENCIES OF THE DECAY MODES OF POSITIVE K-MESONS AND THE DECAY SPECTRA OF MODES $K_{\mu 3}$, τ' AND K_β. G.Alexander, R.H.W.Johnston and C.O'Ceallaigh. Nuovo Cimento, Vol. 6, No. 3, 478-500 (Sept., 1957).

Some 3300 K-meson decay events were studied in a large stack exposed to the positive K-beam at the Berkeley 6 GeV Bevatron. The events were selected in an unbiased way and have been used to yield preliminary information concerning the shape of the energy spectrum of the charged particle emitted in the rarer 3-body decay-modes τ', $\kappa(K_{\mu 3})$ and K_β. The relative abundance of the decay-modes is estimated, the following results being obtained:

Mode	τ	τ'	$K_{\mu 2}$	$\chi(K_{\pi 2})$	$\kappa(K_{\mu 3})$	K_β
%	6.77 ± 0.45	2.15 ± 0.42	57.0 ± 2.6	23.2 ± 2.2	5.9 ± 1.3	5.1 ± 1.3

The number of interactions observed over the first 4 cm from decay of the π-mesons secondary to χ-decay yields the surprisingly short estimate of the interaction m.f.p. of (11.1 ± 2.4) cm. This appears to be in significant disagreement with that found for artificial π^+-mesons by other workers, namely 27 cm in the same energy region. A.

539.12

704. THE INTERACTIONS OF POSITIVE K-MESONS WITH NUCLEI IN PHOTOGRAPHIC EMULSION AT ENERGIES IN THE REGION 0-130 MeV. B.Bhowmik, D.Evans, S.Nilsson, D.J.Prowse, F.Anderson, D.Keefe, A.Kernan and J.Losty. Nuovo Cimento, Vol. 6, No. 3, 440-77 (Sept., 1957).

148 m of K^+ track was followed in an unbiassed way and 109 inelastic interactions with emulsion nuclei found. In addition 3 K^+-proton scattering events were found and numerous cases of elastic scattering from emulsion nuclei. The differential cross-section for the elastic scattering was plotted for three energy intervals and the results compared with those predicted by the optical model for various nuclear well depths. The variation of cross-section with energy for the inelastic events is found to be consistent with isotropy if the Pauli Exclusion Principle is taken into account and the best fit for the experimental points is obtained for a repulsive potential well of 20 MeV. The inelastic events are analysed on the basis of the statistical model of the nucleus and an attempt is also made to obtain from the experimental data the angular distribution in the c.m. system of the K-nucleon cross-section. On any reasonable assumption this appears to be peaked backwards. These data also demand a repulsive potential of ~ 20 MeV. The value of the average K-nucleon cross-section within nuclear matter for meson energies between 40 and 120 MeV is 4 mb/nucleon; allowing for the events forbidden by the exclusion principle this implies a cross-section of 6 mb on a free nucleon. Taking $\sigma_p = (14 \pm 3)$ mb, it follows that $\sigma_n = (2 \pm 2)$ mb. The ratio of charge exchange events to non-charge exchange events is 0.20 ± 0.07 — the value expected in the limit of a vanishingly small interaction in the T = 0 state. A.

539.12

705. OBSERVATION AND ANALYSIS OF K^- INTERACTIONS. J.Hornbostel and G.T.Zorn. Phys. Rev., Vol. 109, No. 1, 165-82 (Jan. 1, 1958).

In nuclear emulsions, 289 K^- mesons were observed. The mass and lifetime of K^- mesons is the same as that of K^+ mesons. The

K^- mean free path in nuclear emulsion is geometric. Charge-exchange scattering and inelastic K^--nucleus scattering are rare. Positive hyperons are emitted in 8% of K^- capture stars, negative hyperons in about 9%, hyperfragments in 5%. It is estimated that a Λ^0 is trapped without production of a visible hyperfragment in an additional 8%. A K^- is captured by one nucleon with formation of a Σ hyperon and a pion in about 0.77 of the cases, with creation of a Λ^0 and a pion in approximately 0.18 of the events. Capture by two nucleons occurs in roughly 0.05 of the cases. From a comparison of production and emission frequencies of Σ hyperons it is concluded that an attractive nuclear potential for Σ hyperons must be less than 20 MeV. Limits for the mean free paths for ordinary scattering, for charge-exchange scattering, and for absorption of Σ hyperons in nuclear matter are given. The trapping of Λ^0 hyperons in nuclei is discussed. A.

539.12

706. NON-ADIABATIC TREATMENT OF THE SCATTERING OF K^+-MESONS BY NUCLEONS. C.Ceolin and L.Taffara.
Nuovo Cimento, Vol. 6, No. 3, 425-39 (Sept., 1957).

The problem of the K^+-nucleon scattering is treated by the method of Tamm—Dancoff in the two-meson approximation, both with scalar and pseudovector coupling. In both cases it turns out that the most important phase at low energy is T = 1, which corresponds to an attractive potential. In the scalar case this phase does not lead to a resonance; in the pseudoscalar case there is, however, a resonant state whose position is strongly dependent on the momentum cut-off K. There is a brief discussion of the results obtained, in relation to the few experimental data so far available. A.

539.12

707. COULOMB CORRECTIONS TO τ-MESON DECAY. E.L.Lomon.
Phys. Rev., Vol. 108, No. 2, 458-60 (Oct. 15, 1957).

The effect of the Coulomb interaction on the energy and angular distribution of the final-state pions in τ-meson decay is calculated by perturbation theory. The result indicates a shift of the order of magnitude of 3% from large to small energies and angles. The result differs in some quantitative aspects from those previously derived by treating some or all of the pions classically. In particular the energy dependence of the correction disappears at low energies. A.

539.12 : 530.145

NON-CONSERVATION OF PARITY AND HYPERON DECAY.
See Abstr. 497

539.12

708. HYPERON PRODUCTION IN NUCLEON—NUCLEON COLLISIONS. G.Feldman and P.T.Matthews.
Phys. Rev., Vol. 109, No. 2, 546-50 (Jan. 15, 1958).

The hyperon production process in nucleon—nucleon collisions is analyzed in terms of isotopic spin, and angular momentum near threshold, to deduce certain tests for global symmetry, charge independence, and the parities of Σ, Λ, and K mesons. Information about the hyperon—nucleon interaction may be obtained from the K-meson spectrum. However, the Σ's and Λ's may interchange owing to this interaction, and Watson's theory of final-state interactions is generalized to allow for this effect. The result is applied to the Σ processes and its significance for the recent calculations of Henley, on the Λ-N final-state interaction is discussed. A.

539.12

709. ISOTOPIC SPIN SELECTION RULES AND PARITY NON-CONSERVATION IN THE DECAY OF THE STRANGE PARTICLES. B.T.Feld.
Nuovo Cimento, Vol. 6, No. 3, 650-63 (Sept., 1957).

The experimental situation is reviewed on the decay ratios of the θ-meson and hyperons from the point of view of testing the validity of the suggested $\Delta T = \pm\frac{1}{2}$ selection rule. Assuming charge-independence, it is shown that the observed decay ratios of the Σ-hyperons require a very large admixture of $\Delta T = \pm\frac{3}{2}$ decay, provided parity is conserved in the decay. However, if the requirement of parity conservation is discarded, the hyperon decay ratios can be accounted for, in a most natural fashion, while still preserving the $\Delta T = \pm\frac{1}{2}$ selection rule. This explanation leads to the prediction of large asymmetries in the angular distributions from the decay of polarized hyperons. Furthermore, these asymmetries are very sensitive to the degree of time-reversal invariance of the decay interaction. A table is given for the expected asymmetry parameters in parity non-conserving hyperon decays with and without time-reversal invariance. A.

539.12

710. CHARGE DENSITY IN THE DEUTERON. J.Bernstein.
Phys. Rev., Vol. 108, No. 2, 349-52 (Oct. 15, 1957).

The phenomenological theory of the deuteron charge distribution is discussed. Finite nucleon sizes are included. The theory is applied to the deuteron quadrupole moment, the low-energy photonuclear reaction $\gamma + d \rightarrow n + p$, and elastic electron-deuteron scattering. It is shown, that these phenomena can be given a consistent phenomenological treatment under the simplest assumptions. A.

539.12

711. THE POLARIZATION OF ELASTICALLY SCATTERED DEUTERONS. O.D.Cheĭshvili.
Zh. éksper. teor. Fiz., Vol. 32, No. 5, 1240-2 (1957). In Russian.

An optical model calculation which gives approximate agreement with experiment at 160 MeV. W.O.Lock

NUCLEUS

539.14

712. NON-STATIC EFFECTS ON INDIVIDUAL NUCLEONS IN A SPHEROIDAL POTENTIAL. W.E.Frahn and R.H.Lemmer.
Nuovo Cimento, Vol. 6, No. 3, 664-73 (Sept., 1957).

A generalized single-particle wave-equation is derived in the effective mass approximation, starting from a non-local potential matrix for the nucleon—nucleus interaction as required by recent work on the nuclear many-body problem. The effective nucleon mass appearing in the kinetic energy operator of this equation depends on the shape of the local potential which is assumed as the static limit of the non-local interaction. The non-static effects on the motion of individual nucleons in non-spherical nuclei are illustrated using a spheroidal oscillator potential. By a perturbation treatment of the energy eigenvalue problem, is is shown that the non-static problem is approximately equivalent to a static one with a modified deformation parameter. A.

539.14

713. COLLECTIVE MOTIONS IN NUCLEI BY THE METHOD OF GENERATOR COORDINATES. J.J.Griffin and J.A.Wheeler.
Phys. Rev., Vol. 108, No. 2, 311-27 (Oct. 15, 1957).

For an A-particle system, a trial wave-function is constructed of the form

$$\Psi(x_1,\ldots,x_A) = \int \varphi(x_1,\ldots,x_A;\alpha)\, f(\alpha)\, d\alpha.$$

The preliminary nucleonic wave-function, φ, solves the problem in a "construction potential". This potential depends upon a "deformation parameter" or "generator coordinate", α. The collective wave-function, $f(\alpha)$, or "generator function", is folded into φ to produce a system wave-function that depends only upon the coordinates, x_i, of the particles. In the integration, the deformation parameters dissolve away. They do not appear in the final state function; they only generate it. No collective coordinates ever come into use nor do such coordinates ever have to be defined. In typical cases when the generator function contains one or more nodes, it generates nodes in the system wave-function Ψ of the kind that describe collective kinetic energy. The energy of the system is extremized with respect to choice of the generator function, $f(\alpha)$. No Hamiltonian ever appears except the A-particle Hamiltonian. All nucleons are treated on the same basis whether in or above closed shells. The appropriate variational calculation leads to an integral equation or "generator wave-equation" for $f(\alpha)$. This equation is solved in two limiting cases: the quadratic approximation, and the δ-function approximation. An analysis is made of the Peierls—Yoccoz (Abstr. 6425-6/1957) procedure to calculate the effective-mass parameter in cases where the forces acting in the system are invariant with respect to translation or rotation. There is no external machinary to drive the construction potential. The effective inertial constant does not appear likely to agree in general with that calculated for the essentially different problem of particles in such a machine-driven potential, though the latter value is presumably more nearly correct for physical applications. The trial wave-function in the method of generator coordinates is designed for simplicity, not for precision. It is applied in the following abstract to the dilatational and shape oscillations of O^{16}. A.

539.14

714. OXYGEN-16 BY THE METHOD OF GENERATOR COORDINATES. J.J.Griffin.
Phys. Rev., Vol. 108, No. 2, 328-35 (Oct. 15, 1957).

Dilatational and collective quadrupole excitations of the nucleus O^{16} are treated by the method of generator coordinates described in the preceding abstract. In this method, one starts from assumed

two-body forces and calculates the stiffness, inertial, and frequency of the collective motion. Numerical results are presented for these quantities. Experimental data relative to collective 0+ and 2+ states in O^{16} are summarized, and other theoretical treatments of this problem are discussed. It is noted that collective models all imply too large a matrix element for the decay of the 6.06 MeV (0+) state. It is concluded that this state is not primarily a dilatational excitation. Similar considerations apply to the 6.91 MeV (2+) state. A.

539.14

715. WEAK COLLECTIVE EFFECTS IN THE NUCLEAR SHELL MODEL. R.D.Amado.
Phys. Rev., Vol. 108, No. 6, 1462-72 (Dec. 15, 1957).

Configuration mixing between the odd particle and the core is formulated to account for the weak collective quadrupole effects near closed shells. The configuration mixing sum is evaluated formally for the general case and applied to O^{17}. An equivalent formalism in which closure is done over the configuration mixing sum is developed and applied to O^{17}, giving good agreement with experiment. The closure result is found to be very insensitive to variation of parameters. The closure formalism is also applied near the lead closed shell, using a nuclear charge density distribution for the core instead of a sum over particle states. The collective effects in this region are well accounted for, and the formalism is compared with that for weak surface coupling. A.

539.14

716. SUPERHEAVY NUCLEI. F.G.Werner and J.A.Wheeler.
Phys. Rev., Vol. 109, No. 1, 126-44 (Jan. 1, 1958).

The semiempirical mass formula and other data previously extrapolated indicated possible existence of nuclei with mass values up to twice the largest now known. Here this mass region is further explored. Extrapolations are revised and the properties of such superheavy nuclei are estimated in more detail. Despite Z values substantially higher than 137, the K electrons behave perfectly normally because of the finite extension of the nucleus. Vacuum polarization and vacuum fluctuations are roughly estimated to make relatively minor alterations in the K electron binding — which exceeds mc^2. The effect of nuclear attraction in speeding up beta decay is calculated approximately. Calculated beta lives are never much less than 10^{-4} sec. Beta decay energies and neutron binding energies are calculated from the semiempirical mass formula. Fission barriers and cross-sections for the (n,γ) process are estimated. Branching ratios in beta decay are calculated for the processes of simple beta decay and for "delayed" neutron emission and "delayed" fission. The latter quantity sets an irreducible minimum to the losses that occur in the process of buildup under even the heaviest neutron flux. The calculated fractional yield of nuclei which reach $Z = 147$, $A = 500$ is > 0.05. Under a lower flux the losses are greater. All stability calculations in this paper depend upon substantial extrapolations, with complete disregard of shell effects and other particularities that may be important, and therefore can be completely in error. Conversely, observation of existence or absence of superheavy nuclei with lives less than a second should test stringently the semiempirical mass formula and the semiempirical estimates of spontaneous fission barriers. A.

539.14

717. THE ODD-PARITY STATES OF ^{16}O AND ^{16}N.
J.P.Elliott and B.H.Flowers.
Proc. Roy. Soc. A, Vol. 242, 57-80 (Oct. 15, 1957).

The properties of the odd-parity states of O^{16} and N^{16} are calculated insofar as they may be considered to arise from the configurations $p^{-1}d$ and $p^{-1}2s$. The calculations are performed in intermediate coupling, including the spin—orbit splittings of the p and d shells, and full account is taken of the mixing of the two configurations. A satisfactory picture can be given of the known odd-parity levels of both nuclei, although some anomalous features, apparently associated with the detailed nature of nuclear forces, remain without full explanation. Some remarks are made regarding the photodisintegration of oxygen and it is found that the shell model can account satisfactorily for the observed photon widths which constitute the giant resonance. A.

539.14

718. SPIN MAGNETIC MOMENT OF P^{32} BY THE ELECTRON NUCLEAR DOUBLE-RESONANCE TECHNIQUE.
G.Feher, C.S.Fuller and E.A.Gere.
Phys. Rev., Vol. 107, No. 5, 1462-4 (Sept. 1, 1957).

539.14 : 539.19

719. DISTORTIONS OF MAGNETIC RESONANCES BY ADDITIONAL AND EXCESSIVE OSCILLATORY FIELDS.
H.R.Lewis, A.Pery, W.Quinn and N.F.Ramsey.
Phys. Rev., Vol. 107, No. 2, 446-9 (July 15, 1957).

In the presence of an extraneous oscillatory field, the frequency at which transition probabilities are maximized in magnetic resonance (molecular beams and nuclear resonance) experiments is shifted. Experimental measurements of this shift are described. An extension of the theory underlying this effect is given and the results of an experiment verifying the theory are presented. A distortion of molecular beam resonances occurring under certain circumstances when oscillating fields of excessive magnitude are used is also described, and some experimental work on this effect is summarized. A.

539.14 : 539.2

720. NUCLEAR MAGNETIC RESONANCE SPECTRUM FOR ISOSCELES TRIANGULAR CONFIGURATIONS OF NUCLEI.
E.R.Andrew and N.D.Finch.
Proc. Phys. Soc. B, Vol. 70, Pt 10, 980-90 (Oct., 1957).

The nuclear magnetic resonance spectrum is calculated for an assembly of isotropically oriented systems of three identical nuclei of spin number $\frac{1}{2}$ situated at the corners of an isosceles triangle. The theoretical spectra for triangles departing in various degrees from equilateral shape are compared with those recorded by Richards and Smith for the monohydrates of nitric and perchloric acids in polycrystalline form. It is concluded that if the oxonium ion in these acid hydrates is not equilateral, it does not depart from that shape by more than 10%. Inter-ionic broadening is examined and it is concluded that for the acid hydrates a Gaussian function gives a good description of this broadening. A.

539.14

721. THE TEMPERATURE DEPENDENCE OF THE OVERHAUSER EFFECT IN METALLIC LITHIUM.
N.A.Bekeshko and E.I.Kondorskiĭ.
Zh. éksper. teor. Fiz., Vol. 32, No. 3, 611-12 (1957). In Russian.

The enhancement of nuclear resonance due to saturation of conduction-electron spin resonance was predicted by Overhauser and observed in Li by Carver and Slichter (Abstr. 1565, 1566/1954). The present authors report briefly on the temperature dependence of the effect between 0 and 80°C, using a d.c. magnetic field of 30.1 Oe. The observed decrease of the effect with increasing temperature agrees qualitatively with theory. J.B.Arthur

539.14

722. HYPERFINE-STRUCTURE SEPARATIONS AND MAGNETIC MOMENTS OF Rb^{81}, Rb^{82}, Rb^{83}, AND Rb^{84}.
J.C.Hubbs, W.A.Nierenberg, H.A.Shugart, H.B.Silsbee and R.J.Sunderland.
Phys. Rev., Vol. 107, No. 3, 723-7 (Aug. 1, 1957).

Measured by an atomic-beam magnetic resonance method, the hyperfine-structure separations and magnetic moments of four neutron-deficient isotopes are found to be

Rb^{81}, $\Delta\nu = 5097 \pm 13$ Mc/s, $\mu_I = +2.05 \pm 0.02$ n.m.;
Rb^{82}, $\Delta\nu = 3094.1 \pm 2.4$ Mc/s, $\mu_I = +1.50 \pm 0.02$ n.m.;
Rb^{83}, $\Delta\nu = 3183.3 \pm 5.8$ Mc/s, $\mu_I = +1.42 \pm 0.02$ n.m.;
Rb^{84}, $\Delta\nu = 3077.5 \pm 5.1$ Mc/s, $\mu_I = -1.32 \pm 0.02$ n.m.

A.

539.14

723. HYPERFINE STRUCTURE AND QUADRUPOLE MOMENT OF LANTHANUM 139. Yu Ting.
Phys. Rev., 108, No. 2, 295-304 (Oct. 15, 1957).

The hyperfine structure of La^{139} in the ground level $5d6s^2\ ^2D$ was studied by the atomic-beam magnetic resonance method. The beam of lanthanum atoms was detected by a hot tungsten filament operated at 2680 ± 30°K. Of the eight hyperfine intervals resulting from the interaction of a nuclear spin of $\frac{7}{2}$, with the J values of the ground state, seven were measured. They are, for $J = \frac{5}{2}$,

$\nu_1 = W(F = 6) - W(F = 5) = 1120.902 \pm 0.005$ Mc/s,
$\nu_2 = W(F = 5) - W(F = 4) = 912.793 \pm 0.005$ Mc/s,
$\nu_3 = W(F = 4) - W(F = 3) = 716.288 \pm 0.003$ Mc/s,
$\nu_4 = W(F = 3) - W(F = 2) = 529.090 \pm 0.010$ Mc/s,

and for $J = \frac{3}{2}$,

$\nu_5 = W(F = 5) - W(F = 4) = 737.967 \pm 0.015$ Mc/s,
$\nu_7 = W(F = 4) - W(F = 3) = 551.987 \pm 0.005$ Mc/s,
$\nu_8 = W(F = 3) - W(F = 2) = 391.603 \pm 0.010$ Mc/s.

From these values the magnetic dipole interaction constants are

found to be A'($J = \frac{5}{2}$) = 182.1706 ± 0.0006 and A''($J = \frac{3}{2}$) = 141.1959 ± ± 0.0016 Mc/s, the quadrupole interaction constants to be B' = 54.213 ± 0.014, and B'' = 44.781 ± 0.014 Mc/s, while the octupole interaction constants are zero within the accuracy of the experiment. The unobserved line of the $^2D_{5/2}$ hyperfine multiplet is calculated to be ν_5 = W(F = 2) − W(F = 1) = 348.843 ± 0.014 Mc/s. A serious discrepancy was noted between the observed A values, both relatively and absolutely, and those given by theory. The assumption of s-configuration mixing apparently resolved this difficulty. The values of the nuclear quadrupole moment calculated from B' and B'' are fairly consistent with each other. The average value, after application of the Sternheimer correction is $Q = (0.269 \pm 0.010) \times 10^{-24}$ cm^2. A.

539.14

724. SOME APPLICATIONS OF SCINTILLATION SPECTROMETRY IN THE STUDY OF NUCLEAR PROPERTIES. N.L.Svantesson.
University of Lund Dissertation (1957) 15 pp.

Previously published work on internal and external bremsstrahlung from the β-decay of S^{35}, the photodisintegration of O^{16} and the photoexcitation of C^{12} is reviewed, and the results of irradiating natural magnesium with bremsstrahlung from 7 to 25 MeV are described. Photoproduction of 10 MeV radiation was observed, a threshold at 10 MeV being ascribed to elastic scattering from a 10 MeV level in Mg^{24}, and a further threshold at 19 MeV being assigned to the $Mg^{25}(\gamma,n\gamma')Mg^{24}$ reaction. Cross-sections for these two reactions were calculated, and from them the level width of the 10 MeV state in Mg^{24}, which, on the single particle model, indicates an E1 transition to the ground state. It is concluded that the 10 MeV level is $J = 1^-$, T = 1. The cross-section curve for production of 10 MeV radiation coincides with (γ,n) and (γ,p) resonances seen by others, and shows that 10 MeV states result from about 20% of (γ,n) disintegrations. D.R.Chick

539.14

725. A NOTE ON THE SELECTIVE ABSORPTION OF PHOTONS BY NUCLEAR LEVELS. J.Goldemberg.
An. Acad. Brasil. Ciênc., Vol. 29, No. 1, 23-6 (1957). In Portuguese.

Measurements by E.G.Fuller (personal communication to the author) of the characteristics of the 16 MeV level of C^{12} allow an analysis of an experiment by the author (Abstr. 7697/1954) on the selective absorption by this level of a continuous spectrum of γ-rays. It is found that the negative result of this experiment was due to insufficient experimental resolution, since the actual width of the level is about 20 times smaller than anticipated. L.Pincherle

539.14

726. EXCITED STATES IN O^{16} NEAR 11 MeV.
J.L.Weil, K.W.Jones and L.J.Lidofsky.
Phys. Rev., Vol. 108, No. 3, 800-1 (Nov. 1, 1957).

A search was made for excited states in O^{16} in the region of 11 MeV excitation using the counter-ratio method to detect slow-neutron thresholds in the reaction $N^{15}(d,n)O^{16*}$. Thresholds were observed which correspond to excited states at 10.935 ± 0.010 and 11.061 ± 0.015 MeV. A review of all the present experimental information on the excited states in this region is given. A.

539.14

727. NUCLEAR HYDRODYNAMICS AND THE SIGNIFICANCE OF THE ENERGY WIDTH OF THE NUCLEAR γ-RESONANCE. K.Wildermuth and H.Wittern.
Z. Naturforsch., Vol. 12a, No. 1, 39-59 (Jan., 1957). In German.

Collisions between the individual nucleons in the nucleus are considered to cause the damping width of the giant dipole resonance. The energy width ΔE is calculated on the basis of this, using nuclear hydrodynamics developed by Wild. For an atomic weight A = 260, one obtains ΔE = 6.42 MeV, and a corrected value ΔE = 5.55 MeV. For application to real nuclei, the laws $\Delta E = 6.42\ (260/A)^{2/3}$ MeV and $\Delta E = 5.55\ (260/A)^{2/3}$ MeV, respectively, hold. G.E.Brown

539.14

728. EXCITED STATES IN Be^7 AND Be^8.
J.C.Slattery, R.A.Chapman and T.W.Bonner.
Phys. Rev., Vol. 108, No. 3, 809-11 (Nov. 1, 1957).

The neutron-threshold method was used to observe the neutrons emitted in the deuteron bombardment of both Li^6 and Li^7. From the bombardment of Li^6, two broad thresholds were observed corresponding to levels in Be^7 at excitation energies of 6.5 MeV (Γ = 1.2 MeV) and 7.2 MeV (Γ = 0.5 MeV). Four thresholds were observed in the bombardment of Li^7, corresponding to excited-state energies in Be^8 of 16.07 MeV, 16.65 MeV, 17.60 MeV, and 18.19 MeV. A.

539.14

729. INFLUENCE OF SHELL STRUCTURE ON THE LEVEL DENSITY OF A HIGHLY EXCITED NUCLEUS. N.Rosenzweig.
Phys. Rev., Vol. 108, No. 3, 817-26 (Nov. 1, 1957).

Some features of the influence of shell structure on the level density of a highly excited nucleus (≅ 10 MeV) are studied on the basis of an idealized independent-particle model for which accurate formulae can be obtained in closed form. The theory is especially useful for estimating the ratio of the level densities of two nuclei in which the same degenerate (shell model) levels are being filled in the ground state, but which differ by a few units in the number of particles which occupy these levels. Observable effects persist to high energies (≅ 10 MeV) and they become very large in the neighbourhood of the magic numbers. Thus, it is possible to determine experimentally whether or not the shell model of the nucleus retains any validity at high excitations. A.

539.14

730. NUCLEAR LEVEL DENSITIES. A.A.Ross.
Phys. Rev., Vol. 108, No. 3, 720-5 (Nov. 1, 1957).

By using the statistical methods originally due to Bethe, the predictions for the densities of nuclear energy levels at excitation energies around 8 MeV are examined for two different versions of the shell model. A crude method is used to take into account the effects of shell structure. The assumed form of the theoretical expression for the density of nuclear energy levels is employed to analyse the data from slow-neutron resonance experiments and from fast (n,γ) cross-sections. In contrast to earlier results, for the necessary potential radius, it is found that either the static diffuse potential with a radius of $\sim 1.2 \times 10^{-13} \times A^{1/3}$ cm, or the diffuse velocity-dependent potential based on the Johnson—Teller model with a radius of $\sim 1.4 \times 10^{-13} \times A^{1/3}$ cm, leads to fair agreement with the above experiments. In each case the values of the thickness of the surface layer on the nuclear potential and the magnitude of the spin—orbit coupling are taken to be those previously found to give close agreement with the experimental shell-model level sequences. The level-density expressions used here lead to an energy dependence which is in even stronger disagreement with those derived from various excitation function and inelastic scattering experiments than the empirical formula of Blatt and Weisskopf (Abstr. 4335/1953). It is argued that this anomaly may cast more light on the use of the statistical theory of nuclear reactions than on the validity of the expression for nuclear level densities. A.

539.14

731. A SHORT LIVED ISOMERIC STATE OF ^{208}Bi.
S.De Benedetti, U.Farinelli, F.Ferrero, R.Malvano, G.Pelli and C.Tribuno.
Nuovo Cimento, Vol. 6, No. 3, 682-5 (Sept., 1957).

A previously known isomeric activity of 2.5 msec from irradiation of Bi is assigned to Bi^{208}. The method used was the observation of the excitation curve from betatron radiation on stable Bi: the shape of the curve and its threshold are characteristic of (γ,n) reactions. The problem of the ground state of Bi^{208} is discussed. A.

539.14

732. LIFETIMES OF THE 6.91 AND 7.12 MeV EXCITED STATES OF O^{16}. C.P.Swann and F.R.Metzger.
Phys. Rev., Vol. 108, No. 4, 982-8 (Nov. 15, 1957).

The mean lives of the 6.91 and 7.12 MeV excited states of O^{16} were measured through a nuclear resonance scattering experiment. The $F^{19}(p,\alpha)O^{16*}$ reaction was used as the source of Doppler-broadened gamma radiation. The relative intensities of the 6.91 and 7.12 MeV gamma-ray lines in this source were determined by observations of the associated alpha-particles. From the magnitude of the resonance fluorescence effect and the angular distribution, mean lives of $(1.2 \pm 0.2) \times 10^{-14}$ sec for the 6.91 MeV level and $(1.0 \pm 0.3) \times 10^{-14}$ sec for the 7.12 MeV level were calculated. A.

539.14

733. LIFETIME OF THE 247 keV EXCITED STATE OF Cd^{111}. P.C.Simms and R.M.Steffen.
Phys. Rev., Vol. 108, No. 6, 1459-61 (Dec. 15, 1957).

It is shown that lifetime measurements of excited nuclear states may be influenced by extranuclear effects. By a proper choice of the chemical and physical form of the radioactive source this effect can be practically eliminated. Considering this extranuclear perturbation the lifetime of the 247 keV state of Cd^{111} was determined as $\tau_N \approx (122.3_{-0.8}^{+1.2})$ millimicroseconds. Experimental evidence of the influence of extranuclear effects on lifetime measurements is presented. A.

539.14

734. PLUTONIUM-237 m, ANOTHER CASE OF E3 ISOMERISM FOR NEUTRON NUMBER 143.
F.S.Stephens, Jr, F.Asaro, S.Amiel and I.Perlman.
Phys. Rev., Vol. 107, No. 5, 1456-8 (Sept. 1, 1957).

An isomeric state lying at 145 keV above the ground state of Pu^{237} is excited in the α-decay of Cm^{241} and decays with a half-life of 0.18 ± 0.02 sec. The values for α_K (less than 0.3) and α_L(39 ± 8) identify this transition as E3, and spins of $\frac{7}{2}^-$ and $\frac{1}{2}^+$ are proposed for the ground and excited states of Pu^{237}. M.A.Grace

539.14

735. ON THE ISOMERISM OF INDIUM^{114}. K.W.Hoffmann.
Z. Phys., Vol. 148, No. 3, 298-302 (1957). In German.

A split-crystal anthracene spectrometer was used to measure the total-conversion coefficient α = 4.3 ± 0.4 and the K/L ratio = 2.0 ± 0.6 for the isomer In^{114m}, in agreement with an E4 transition. A.O.Stanesby

539.14

736. PHENOMENOLOGICAL CONSIDERATION ON THE HYPERFRAGMENTS. Y.Poc Kwon, J.Ôba and T.Gotô.
Nuovo Cimento, Vol. 6, No. 4, 832-40 (Oct., 1957).

On the basis of a simple model, the binding energy of the Λ^0 in hyperfragments is calculated and the nature of the Λ^0—nucleon force is discussed. On the same basis the Z-spectrum of hyperfragments produced in nuclear emulsions is also considered. A.

RADIOACTIVITY

539.16.08 : 551.594.14

737. DETERMINATION OF RADON AND THORON IN AIR.
G.B.Courtier.
Nature (London), Vol. 180, 382-3 (Aug. 24, 1957).

Detection of radon in air has been reported by filtration of approximately 1 m^3 and measurements of mixed daughter activity on the filter. A larger volume of air is required for thoron. In this report, general mathematical expressions are put forward to relate the radon concentration with the observed mixed daughter activity (a) for decay products in equilibrium, (b) if not in equilibrium — following further decay storage period to allow transient equilibrium. Expressions for thoron are not included but can be formulated similarly. D.R.Chick

539.16.08

738. MEASUREMENT OF TRITIUM.
C.Eaborn, E.Matsukawa and R.Taylor.
Rev. sci. Instrum., Vol. 28, No. 9, 725-6 (Sept., 1957).

Several aspects of the experimental technique are described in detail by which the method previously described for measuring tritium (Abstr. 3586/1957) can be considerably improved in sensitivity and accuracy. The lower limit of measurement is now about 3×10^{-2} μcuries of tritium. L.E.Mussell

539.163

739. THE EMISSION FROM As^{76}. E.P.Grigor'ev, L.V.Gustova, A.V.Zolotavin, B.Kratsik, T.V.Poleshchuk and O.V.Chubinskiĭ.
Vestnik Leningrad. Univ., Ser. Fiz.Khim., 1957, No. 10, 37-9.
In Russian, with summary in English.

Results are given of a study of the β- and γ-emission of As^{76} which has a half-life of 26.75 hours. Using a double focusing β-spectrometer five components were found with end-point energies (relative intensities are given in brackets): 350 (4), 880 (3), 1760 (7), 2410 (28), 2960 (58) keV. Working over an energy range 1-4.5 MeV a γ-hodoscope recorded γ-rays with energies (relative intensities are given in brackets): 1.21 (1.0), 1.43 (0.1), 1.76 (0.07), 2.10 (0.14), 2.42 (0.006), 2.65 (0.006) MeV. C.R.S.Manders

539.163.2

740. DECAY OF MOLYBDENUM-91.
J.D.Prentice and K.G.McNeill.
Phys. Rev., Vol. 107, No. 4, 1041-3 (Aug. 15, 1957).

A study was made of the radioactivity of Mo^{91} and Mo^{91m}, produced by X-irradiation of natural molybdenum, in order to clarify the decay scheme of this isotope. The gamma-ray spectrum was measured using scintillation spectrometers and coincidence circuits. Three gamma-rays which had a half-life of 64 sec were found at 1.50, 1.20, and 0.65 MeV. The first two were in coincidence with positrons but not with each other, while the 0.65 MeV gamma-ray was not in coincidence with positrons or with the two other gamma-rays. The intensities of the gamma-rays were in the ratios 1.5 1.5 MeV : 1.2 MeV : 0.65 MeV = 39 : 39 : 100. By using a plastic scintillator, positrons from the ground state of Mo^{91} (15 min half-life) were found to have an end-point energy of 3.3 MeV while two positron groups from the isomeric state were found with energies differing by 0.2 ± 0.1 MeV. On the available evidence a decay scheme is suggested. A.

539.163.2

741. RADIOACTIVE DECAYS OF Au^{194}, Au^{196}, AND Au^{198}.
D.E.Alburger.
Phys. Rev., Vol. 108, No. 3, 812-16 (Nov. 1, 1957).

The de-excitations of the 2+ second excited states of Pt^{194} and Pt^{196} were studied to compare crossover transition intensities to the 0+ ground states relative to the known cascade transitions to the 2+ first excited states. An intermediate-image beta-ray spectrometer was used to measure the internal-conversion electron spectra occurring in the decays of Au^{194} and Au^{196}. A conversion line is found in the decay of Au^{194} corresponding to a 0.618 MeV crossover having a transition intensity of 25% relative to the 0.290 MeV cascade, provided the latter is assumed to be E2. In Pt^{196} an upper limit of 0.04% is placed on the intensity of a possible crossover transition compared with the 0.331 MeV cascade. Au^{194} exhibits the internal-conversion lines of 36 gamma-ray transitions which fit energetically into a proposed energy level scheme for Pt^{194}. A search in the electron spectrum of Au^{196} showed no gamma-ray transitions other than the three already known. A.

539.164 : 539.166

742. $\alpha-\gamma$ ANGULAR CORRELATION IN Pu^{239}. G.Y.Petit.
C.R. Acad. Sci. (Paris), Vol. 245, No. 22, 1916-18 (Nov. 25, 1957).
In French.

The angular correlation between the Pu^{239} α-particles and the 51 keV γ-radiation in U^{235} is accounted for by an attenuated correlation with level spins $\frac{1}{2}+$, $\frac{5}{2}+$, $\frac{3}{2}+$. M.A.Grace

539.164

743. FINE STRUCTURE OF THE α-SPECTRA OF U^{234} AND U^{238}. B.A.Bochagov, A.P.Komar and G.E.Kocharov.
Zh. éksper. teor. Fiz., Vol. 32, No. 5, 1257-9 (1957). In Russian.

Main levels are reported at 4.66 MeV and 4.18 MeV with subsidiary levels at 4.72 and 4.135 MeV, for U^{234} and U^{238} respectively; evidence for a third level is interpreted as conversion electrons detected by the ionization chamber used. W.O.Lock

539.165

744. A STUDY OF THE β^+ RADIATION EMITTED BY THE LONG-LIVED ISOMER OF TECHNETIUM 95.
C.Levi, L.Papineau and N.Saunier.
C.R. Acad. Sci. (Paris), Vol. 245, No. 22, 1918-20 (Nov. 25, 1957).
In French.

Weak β^+ spectra (approx. 10^{-3}/disintegration) with end-points at 680 ± 30 and 460 ± 30 keV and of similar intensity are found to accompany the decay of 60 day Tc^{95}: the low energy group leads to the 290 keV level in Mo^{95}. The comparative half-lives of these (log ft = 9.7 and 9) show them to be of the type $\Delta I = 2$, yes. M.A.Grace

539.165

745. BETA INTERACTION IN THE DECAY OF Cs^{137}.
T.Katoh, M.Nozawa, Y.Yoshizawa and Y.Koh.
J. Phys. Soc. Japan, Vol. 12, No. 6, 738 (June, 1957).

The β-spectrum of Cs^{137} was measured and the ground state transition analysed. Assuming this to be a second forbidden transition ($\Delta I = 2$) and the β-decay to involve a linear combination of scalar and tensor interactions it is found that the correct momentum distribution is obtained if $G_S/G_T = -1$. M.A.Grace

539.165

746. PARITY AND ELECTRON POLARIZATION: Au^{198}.
H.Frauenfelder, R.Bobone, E.von Goeler, N.Levine, H.R.Lewis, Jr, R.N.Peacock, A.Rossi and G.DePasquali.
Phys. Rev., Vol. 107, No. 3, 909-10 (Aug. 1, 1957).

Mott scattering was used to show that β-rays (v/c = 0.6) in the decay of Sc^{46}($4^+ \rightarrow 4^+$) have a longitudinal polarization -0.34 ± 0.10; for Au^{198} ($2^- \rightarrow 2^+$) with values of v/c up to 0.9 the polarization determined both by Mott and by Møller scattering was small or zero. It is suggested that this small polarization is due to the dominance of the vector interaction in Fermi transitions. M.A.Grace

539.165

747. PARITY AND ELECTRON POLARIZATION: $0 \rightarrow 0$ TRANSITION IN Ga^{66}. H.Frauenfelder, A.O.Hanson, N.Levine, A.Rossi and G.DePasquali.
Phys. Rev., Vol. 107, No. 3, 910-11 (Aug. 1, 1957).

For positrons with $v/c = 0.98$ the longitudinal polarization is $+0.09 \pm 0.31$ as determined by Møller scattering. This β-decay is believed to be a pure Fermi transition and the result is in accord with a suggestion that parity is conserved in this type of transition. M.A.Grace

539.165 : 539.166

748. BETA–GAMMA CIRCULAR POLARIZATION CORRELATION MEASUREMENTS. F.Boehm and A.H.Wapstra.
Phys. Rev., Vol. 106, No. 6, 1364-6 (June 15, 1957).

Owing to non-conservation of parity, γ-rays following β-transitions are circularly polarized. The probability of emission at an angle θ with the preceding β-particle is proportional to $1 \pm A(v/c)\cos\theta$ (+ for right-handed polarization). An apparatus is described for the study of coincidences between β-particles and Compton-scattered γ-rays, which utilizes the polarization dependence of the Compton scattering cross-section. For Co^{60} A was measured to be -0.40 ± 0.09, consistent with the theoretical value -0.33. For Au^{198}, $A = +0.52 \pm 0.16$, a result which excludes a spin 3 for the ground state and indicates that the spin changes direction in roughly 2/3 of the Au^{198} decays. Experiments were also made on the circular polarization of the bremsstrahlung of β-particles from Tm^{170}. L.Pincherle

539.165 : 539.166

749. β–γ CIRCULAR POLARIZATION CORRELATION IN A J–J TRANSITION. F.Boehm and A.H.Wapstra.
Phys. Rev., Vol. 107, No. 4, 1202-3 (Aug. 15, 1957).

Measurements were made on Sc^{46} by the method described earlier (see preceding abstract). The asymmetry parameter A was found to be 0.33 ± 0.04. In conjunction with other experimental data, this indicates that the β-interaction must contain at least a combination of S and T, or of V and A interactions. L.Pincherle

539.165 : 539.166

750. β–γ CIRCULAR POLARIZATION CORRELATION IN Au^{198} AND Co^{58}. F.Boehm and A.H.Wapstra.
Phys. Rev., Vol. 107, No. 5, 1462 (Sept. 1, 1957).

Reversal of the magnetic field in the circular polarization detector (see the two preceding abstracts) causes changes in the β–γ coincidence rate of $(+0.75 \pm 0.12)\%$ for Au^{198} and $(-0.27 \pm 0.13)\%$ for Co^{58} and these yield values of the asymmetry parameter A of $+0.52 \pm 0.09$ and -0.14 ± 0.07 respectively. The Co^{58} result is in agreement with the theoretical value for an almost pure Gamow–Teller transition while that of Au^{198} is compatible with parity conservation in the S (or V) coupling. M.A.Grace

539.165.2

751. A PROPOSED β-DECAY INTERACTION. M.A.Preston.
Canad. J. Phys., Vol. 35, No. 9, 1017-20 (Sept., 1957).

It is shown that one can retain the two-component neutrino theory and time reversal with scalar and tensor interactions in the β-decay Hamiltonian, if one postulates that the scalar term produces neutrino emission and the tensor term antineutrino emission. This is is consistent with all present experimental data. A.

539.165.2

752. ON THE HAMILTONIAN OPERATOR OF BETA THEORY. P.Bocchieri and E.Montaldi.
Nuovo Cimento, Vol. 6, No. 3, 710-18 (Sept., 1957). In Italian.

The mathematical behaviour of the Hamiltonian H of the beta-theories when acting on some subspaces of the von Neumann infinite direct product space $\mathcal{H}^*$ is considered. It is shown that the properties of H in one of these subspaces coincide from a mathematical point of view with those of the Hamiltonian in the Lee model. In another subspace one finds a model of field theory without renormalizations. It is also shown that the eigenvectors of H do not form a complete set in $\mathcal{H}^*$. A.

539.166 : 539.172.4

GAMMA-RAYS FROM REACTOR FUEL ELEMENTS. See Abstr. 349

539.166.07

753. A ČERENKOV COUNTER AS HIGH ENERGY PHOTON SPECTROMETER. I.Filosofo.
Nuovo Cimento, Vol. 6, No. 3, 701-9 (Sept., 1957).

A Cherenkov counter designed as a high-energy γ-spectrometer is described. Lead glass is used as a medium in which the shower from a γ is both produced and absorbed. The incident energy is measured by means of the Cherenkov light produced in the medium by the electrons of the shower. The counter was calibrated with electrons of energies up to 275 MeV and showed high efficiency, linear response with the energy and energy resolution from ±28% at 80 MeV to ±17% at 275 MeV. Possible improvements of this type of instrument are discussed. A.

539.167 : 539.1.07

754. LINEAR ACCELERATORS AS RADIOISOTOPE PRODUCERS. M.H.MacGregor.
Nucleonics, Vol. 15, No. 11, 176-80 (Nov., 1957).

Photodisintegration enables production of many nuclides that cannot be made by neutron bombardment. Calculation of the yield is explained and production rates of 84 nuclides with 10 kW 20 MeV linear accelerators are listed. R.D.Smith

NUCLEAR REACTIONS

539.17

755. POTENTIAL INELASTIC SCATTERING BY COMPLEX NUCLEI. A.Tomasini.
Nuovo Cimento, Vol. 6, No. 4, 927-36 (Oct., 1957).

It is shown that there exists an inelastic scattering of any type of particle by complex nuclei, due essentially to the perturbation produced by the incident particle on the overall potential experienced by the nucleons of the nucleus. A particle which enters a nucleus and goes out without being captured, determines an increase or a decrease of the overall potential, during the short time it is inside the nucleus; so that the nucleus can make a transition to an excited level. It is shown that the anomalous inelastic scattering of 23 MeV (and 18 MeV) protons by intermediate and heavy nuclei, should be due to such a type of excitation; all quantitative features of the process are well explained, and also the quantitative results are in agreement, in spite of the crude approximations made. A.

539.17

756. PARITY IN NUCLEAR REACTIONS. N.Tanner.
Phys. Rev., Vol. 107, No. 4, 1203-4 (Aug. 15, 1957).

A sensitive test of conservation of parity in nuclear reactions is found in certain (p,α) transitions which are rigorously forbidden by angular momentum and parity conservation. The particular case is taken of the 340 keV resonance of $F^{19}(p,\alpha)O^{16}$, normally giving the 6.14 MeV level of O^{16}. Violation of parity conservation would allow transition to the ground state. Measurements were made of the yield of the reaction in the relevant energy region, and discussion of the results leads to the conclusion that the nuclear interaction conserves parity at least to within 2 parts in 10^4. L.Pincherle

539.17

757. EXCITATION FUNCTIONS UP TO 980 MeV FOR PROTON-INDUCED REACTIONS IN SOME LIGHT ELEMENTS. J.L.Symonds, J.Warren and J.D.Young.
Proc. Phys. Soc. A, Vol. 70, Pt 11, 824-32 (Nov., 1957).

A study has been made of some of the active products from the high-energy bombardment of carbon, nitrogen, oxygen and fluorine. The ratios of cross-sections to the $C^{12}(p,pn)C^{11}$ cross-section were found and the excitation functions estimated. Deviations from a monotonic decrease of cross-section with energy for some reactions have been found and are discussed. Evidence exists for a marked dependence of the (p,pn) cross-section on the energy level structure of the residual nucleus. A.

539.17

758. NUCLEON EXCHANGE IN DEUTERON STRIPPING REACTIONS. A.P.French.
Phys. Rev., Vol. 107, No. 6, 1655-63 (Sept. 15, 1957).

In the normal theory of stripping reactions it is assumed that the outgoing nucleon comes from the incident deuteron. It is well known that this is not strictly justified (although it may be a good approximation in many cases) because of the need in principle to antisymmetrize the total wave-function. This paper discusses the process of stripping with nucleon exchange that appears when the antisymmetry is taken into account. With the help of simplifying assumptions, expressions are obtained for the exchange amplitude in a direct transition between initial and final states of the system. The relation of this treatment to a theory involving compound nucleus formation is discussed. A.

539.17

759. COULOMB EXCITATION OF KRYPTON.
N.P.Heydenburg, G.F.Pieper and C.E.Anderson.
Phys. Rev., Vol. 108, No. 1, 106-7 (Oct. 1, 1957).

Using isotopically enriched samples, observations were made of gamma-ray transitions in krypton from Coulomb excitation by 6.6 and 6.1 MeV alpha-particles. The following energies were obtained for the first excited 2^+ states; Kr^{78}, 450 keV; Kr^{80}, 620 keV; Kr^{82}, 780 keV; and Kr^{84}, 880 keV. No gamma radiation was observed for Kr^{83}. A.

539.17 : 539.12

760. THE ELASTIC CROSS-SECTION OF 2 MeV POSITRONS IN ARGON. C.Giori and C.Succi.
Nuovo Cimento, Vol. 6, No. 4, 937-45 (Oct., 1957). In Italian.

The nuclear elastic scattering of the positrons of energy about 2 MeV was analysed by means of a diffusion cloud-chamber. A total length of 7 762 m was measured in about 24 500 photographs. The total number of scatterings $\geq 20^0$ is 580 with 183 deflections greater than 30^0. The comparison between experimental and theoretical data obtained by applying the method of the projected tracks shows good agreement with the angular distribution of scattering as predicted by the quantum theories. A.

539.17

761. PHOTOPROTONS FROM ^{100}Mo.
F.Ferrero, A.O.Hanson, R.Malvano and C.Tribuno.
Nuovo Cimento, Vol. 6, No. 3, 585-91 (Sept., 1957).

This is an extension of the measurements of the photoproton yield from Mo^{100} up to an energy of 30 MeV. A rather large (γ,p) cross-section is found at a higher energy than that for the (γ,n) reaction. A discussion is given of this evidence implying that the initial states of the protons involved in these transitions are different from those for the neutron or proton states responsible for the giant resonance in the (γ,n) reaction. A.

539.17

762. MEDIUM-ENERGY DEUTERON PHOTODISINTEGRATION.
N.Austern.
Phys. Rev., Vol. 108, No. 4, 973-81 (Nov. 15, 1957).

It is shown that the distinctive features of the photoeffect angular distribution in the energy range 20-100 MeV probably result from a strong modification of the $^3P_0$ outgoing wave amplitude, to be understood as a result of the excitation of virtual mesons in a fashion which violates the Siegert theorem. Some evidence also is found which suggests the need for a repulsive-core modification of the ground-state wave-function. The contributions from the transition $^3D_1 \rightarrow {}^3F_2$ are analysed, and are found to be rather large. A.

539.17

763. NONELASTIC NEUTRON CROSS SECTIONS AT 14 MeV.
M.H.MacGregor, W.P.Ball and R.Booth.
Phys. Rev., Vol. 108, No. 3, 726-34 (Nov. 1, 1957).

Nonelastic neutron cross-sections for 23 elements were measured at 14.2 MeV by means of the sphere transmission technique. Corrections are applied to the data, principally for elastic energy loss, multiple scattering, and finite detector size. The results are compared with predictions of the optical model. A.

539.17

764. INELASTIC SCATTERING OF 2.6 MeV NEUTRONS FROM Fe^{54}, Fe^{56}, AND Fe^{57}. P.Shapiro and R.W.Higgs.
Phys. Rev., Vol. 108, No. 3, 760-5 (Nov. 1, 1957).

Gamma-rays following inelastic scattering of 2.6 MeV d–d neutrons from isotopically enriched samples of Fe^{54}, Fe^{57}, and from normal iron were observed in a NaI scintillation spectrometer using the He^3 coincidence technique. The observed gamma-rays are listed and are assigned to particular isotopes of the elements studied. Decay schemes are proposed for Fe^{54}, Fe^{56}, and Fe^{57}. A.

539.17

765. CAPTURE-TO-FISSION RATIOS FOR FAST NEUTRONS IN U^{235}. B.C.Diven, J.Terrell and A.Hemmendinger.
Phys. Rev., Vol. 109, No. 1, 144-50 (Jan. 1, 1958).

The ratio $\alpha = \sigma_C/\sigma_f$, where σ_C is the neutron capture cross-section and σ_f the neutron-induced fission cross-section, was measured for U^{235} as a function of neutron energy. A pulsed and collimated neutron beam is passed through a U^{235} sample at the centre of a large liquid scintillator. Captures and fissions are detected by means of their prompt gamma-rays; elastic and inelastic scattering events are ignored because of smaller pulse heights. Fissions are distinguished from captures by means of delayed pulses from the capture of thermalized fission neutrons. It is found that in the neutron energy range $E_n = 0.175$ to 1.0 MeV the value of α is given approximately by $A = 0.190 - 0.116 E_n$. The accuracy of the determination of α is 10 to 15% in terms of the standard deviation of individual points. A.

539.17

766. INELASTIC SCATTERING OF 150 MeV NEGATIVE PIONS BY CARBON AND LEAD. R.H.Miller.
Nuovo Cimento, Vol. 6, No. 4, 882-911 (Oct., 1957).

Energy sensitive counters of the Cherenkov or scintillation type were used in conjunction with a pulse-height analyser to measure the energy spectrum of 150 MeV negative pions scattered from carbon or lead at various angles. Most of the pions scattered into the backward hemisphere had an energy less than 40 MeV. This is in contrast to the result of a Monte Carlo calculation based on a simple Fermi gas model, in which most of the pions scattered backwards have energies above 60 MeV. The measurements indicate that the absorption of pions by carbon is about that predicted by the Monte Carlo calculation, while the absorption by lead is about $\frac{1}{4}$ that expected. A.

539.17

767. THE INVERSE REACTIONS $B^{11}(p,\gamma)C^{12}$ AND $C^{12}(\gamma,p)B^{11}$. L.Simons.
Comment. phys.-math. (Helsinki), Vol. 20, Paper 3, 14 pp. (1957).

The cross-section for the reaction $C^{12}(\gamma,p)B^{11}$ is calculated from the measured $B^{11}(p,\gamma)C^{12}$ cross-sections using the reciprocity theorem, and compared over a range of about 2 MeV with measured values. These are much higher than calculated values, there being a giant resonance for γ-rays of energy about 21 MeV. The discrepancy is due to the reaction of γ quanta with single protons of the C^{12} nucleus rather than compound nucleus excitation which is the main process in the $B^{11}(p,\gamma)C^{12}$ reaction. D.R.Chick

539.17

768. RESONANCE FISSION OF U^{235}.
Los Alamos Radiochemistry Group. [B.P.Bayhurst, C.I.Browne, G.P.Ford, J.S.Gilmore, G.W.Knobeloch, E.J.Lang, M.A.Melnick and C.Orth].
Phys. Rev., Vol. 107, No. 1, 325 (July 1, 1957).

Fission-product activity ratios produced by the thermal-neutron fission of U^{235} were compared with those produced by a "slowing-down" or dE/E neutron spectrum using the Los Alamos Water Boiler reactor. There was a consistent reduction in yield with mass number from Zr to Cd in the case of resonance fission.

A.O.Stanesby

539.17 : 621.311.25 : 681.142

769. THE APPLICATION OF DIGITAL COMPUTERS TO NUCLEAR-REACTOR DESIGN. J.Howlett.
Proc. Instn Elect. Engrs, Paper 2507M, publ. Jan., 1958, 7 pp.
To be republished in Vol. 105B (1958).

Reviews the main computational problems arising in the design of a nuclear power reactor. The numerical-mathematical methods available are described briefly in two broad classes, namely the discrete-particle (Monte Carlo) treatment of the neutron-transport problems and the analytical methods based on the transport equation. The use of digital computers in the different methods is discussed in general terms and three examples are considered in more detail: the calculation of the thermal utilization factor for a lattice by the spherical harmonics method, the direct numerical solution of the 2-group diffusion equations for a cylindrical reactor and the calculation by Monte Carlo methods of the resonance escape probability for a graphite–uranium lattice. Finally there is a discussion of the standard of performance of computers likely to be required by nuclear engineers. A.

539.17

770. MEASURING THE PROMPT PERIOD OF A REACTOR.
G.S.Brunson, R.Curran, S.G.Kaufmann, J.McMahon and L.Pahis.
Nucleonics, Vol. 15, No. 11, 132-4, 136, 138, 140-1 (Nov., 1957).

The "Rossi alpha" method of measuring the prompt neutron lifetime of a reactor depends on the detection of two or more neutrons from the same neutron chain. The reactor is run at a very low power and the pulses from a sensitive neutron detector are fed to a special time analysing circuit. The first pulse to arrive opens a gate allowing 1 Mc/s pulses to reach a beam switching tube, the gate being closed by the arrival of a second pulse up to 100 μs later. A count is then registered in the appropriate output channels. After the subtraction of a steady background the probability of the detection of a second neutron as a function of the time interval between is obtained. The probability is proportional

to $e^{\alpha t}$, where $\alpha = (k_p - 1)/T_o$, k_p = prompt reactivity, T_o = mean neutron lifetime. Values of T_o measured in four assemblies in ZPR III range from 4×10^{-8} to 10^{-7} sec. R.D.Smith

539.17

771. EFFECTIVENESS OF CONTROL-ROD MATERIALS. H.P.Iskenderian.
Nucleonics, Vol. 15, No. 11, 150-4 (Nov., 1957).

Formulae are derived for quantitative estimation of the relative effectiveness of different materials in a thermal reactor as a function of thickness and neutron-energy spectrum. Good agreement is obtained with experimental measurements. Europium appears to be the best absorber. R.D.Smith

539.17

772. SWEDISH POWER REACTOR PROPOSAL. R.Liljeblad.
Nucleonics, Vol. 15, No. 11, 165-9 (Nov., 1957).

A design study for a carbon-dioxide-cooled heavy-water-moderated reactor with an output of 444 mW of heat. To avoid the necessity of a large pressure vessel the UO_2 fuel elements are individually contained in pressure tubes. R.D.Smith

539.17 : 537.525

773. PRODUCTION OF HIGH TEMPERATURES AND NUCLEAR REACTIONS IN A GAS DISCHARGE [ZETA]. P.C.Thonemann, E.P.Butt, R.Carruthers, A.N.Dellis, D.W.Fry, A.Gibson, G.N.Harding, D.J.Lees, R.W.P.McWhirter, R.S.Pease, S.A.Ramsden and S.Ward.
Nature (London), Vol. 181, 217-20 (Jan. 25, 1958).

Pulsed currents of up to 200 kA were passed through deuterium gas at a pressure of $\frac{1}{8}\ \mu$ Hg in a toroidal metal discharge tube of 1 metre bore and 3 metre mean diameter, by discharging a 1600 μF 25 kV condenser bank into the 9-turn primary of an iron-cored transformer. The current pulse, which is extended by short-circuiting the condenser bank at voltage zero, lasts about 5 msec. The gas was found to be heated to temperatures, measured from the Döppler widths of spectral lines of nitrogen and oxygen, of from 1 to 5×10^6 °C. The hot gas is constricted by the pinch effect to about $\frac{1}{3}$ metre diameter, and is stabilized for times of milliseconds by a toroidal (B_Z) magnetic field of about 200 gauss, as shown by streak pictures, Langmuir probes, microwave transmission and magnetic probe measurements. D–D reactions were observed to occur for about 1 msec about peak current, at rates consistent with a thermonuclear origin. X-rays of about 20 keV energy have been studied, and also emission spectra in the 400-2500 A u.v. range. R.S.Pease

539.17 : 537.525

774. CO-OPERATIVE PHENOMENA IN HOT PLASMAS. L.Spitzer.
Nature (London), Vol. 181, 221-2 (Jan. 25, 1958).

Reports calculations of the rate at which ions can be heated by collisions with the electrons of a hot electron gas. Concludes that in both Zeta (see preceding abstract) and in an experiment at Princeton, the ion heating observed is too rapid to be accounted for by this mechanism alone, and may be due to cooperative phenomena. R.S.Pease

539.17 : 537.525

775. A STABILIZED HIGH-CURRENT TOROIDAL DISCHARGE PRODUCING HIGH TEMPERATURES. N.L.Allen, T.E.Allibone, D.R.Chick, R.F.Hemmings, T.P.Hughes, S.Kaufman, B.S.Liley, J.G.Mack, H.T.Miles, R.M.Payne, J.E.Read, A.A.Ware, J.A.Wesson and R.V.Williams.
Nature (London), Vol. 181, 222-4 (Jan. 25, 1958).

Reports electrical characteristics, ion temperature measurements, streak pictures and neutron yields obtained by passing gas currents of up to 200 kA through deuterium at about 1 μ Hg pressure in a metal torus of 30 cm diameter bore and 115 cm mean diameter (Sceptre III), using a 30 kV 150 μF capacitor-bank discharging into a 8 or 16 turn primary of an iron-cored transformer. The hot gas is shown to be constricted, and is stabilized for times of about 400 μsec by a toroidal magnetic field of up to 1000 gauss. Doppler widths of spectral lines yield ion temperatures in the range $2.5 - 3.8 \times 10^6$ °C, in good agreement with temperatures calculated from the neutron yield, and from theoretical considerations of the heating process. R.S.Pease

539.17 : 537.525

776. MAGNETIC MEASUREMENT OF PLASMA CONFINEMENT IN A PARTIALLY STABILIZED LINEAR PINCH. L.C.Burkhardt, R.H.Lovberg and J.A.Phillips.
Nature (London), Vol. 181, 224-5 (Jan. 25, 1958).

44-Turn search coils of No. 40 gauge wire wound on 1 mm formers were inserted in a straight discharge tube 30 cm by 6.8 cm diameter, and used to measure the axial (B_Z) and azimuthal components of magnetic field as a function of time for gas currents of 150 kA and initial B_Z of 1000 gauss. By equating magnetic pressure to gas pressure, gas temperatures of up to 4×10^5 °C were inferred to occur. R.S.Pease

539.17 : 537.525

777. NEUTRON PRODUCTION IN A HIGH-POWER PINCH APPARATUS. D.C.Hagerman and J.W.Mather.
Nature (London), Vol. 181, 226-8 (Jan. 25, 1958).

Describes the performance of a straight discharge tube 30 cm by 10 cm diameter, operated with deuterium at ~ 100 μ Hg pressure, at voltages of up to 60 kV, currents of up to 1000 kA with rise times of 2 μsec, and axial magnetic fields of up to 10^4 gauss. Results are compared with those of other workers. Neutrons were produced not only at the time of maximum pinch, but also for periods of up to 1.5 μsec, particularly when an axial magnetic field was applied. Nuclear plate measurements of neutron energies indicate anisotropic deuteron velocities which correspond either to 20 keV deuterons colliding with stationary deuterons, or to a deuteron drift of 7×10^7 cm/sec towards the cathode. R.S.Pease

539.17 : 537.525

778. NEW CONFINEMENT PHENOMENA AND NEUTRON PRODUCTION IN A LINEAR STABILIZED PINCH. L.C.Burkhardt and R.H.Lovberg.
Nature (London), Vol. 181, 228-30 (Jan. 25, 1958).

A straight 24 inch tube of 5 inches diameter, with a close-fitting return conductor, was operated under typical conditions of: 75 μF capacitor-bank charged to 15 kV; maximum current, 250 kA; rise time, 6 μsec; axial magnetic field B_Z, 1750 gauss; initial deuterium pressure, 40 μ Hg. Magnetic probes showed that after about 3 μsec the tube contained not only the initial pinched discharge, but also a sheath of current of opposite sign near the walls. At the time of zero total current, there is a circulating current of about 50 kA in the tube. During the subsequent half-cycle the sheath pinched into the tube centre, carrying contaminants with it. Pressure balance measurements suggest temperatures exceeding 3×10^6 °C. Some of the discharges yielded more than 10^5 neutrons over a 6 μsec period, and variation of yield with capacitor volts and B_Z is consistent with a thermonuclear process. R.S.Pease

537.17 : 537.525

779. NEUTRONS FROM A STABILIZED TOROIDAL PINCH. J.Honsaker, H.Karr, J.Osher, J.A.Phillips and J.L.Tuck.
Nature (London), Vol. 181, 231-3 (Jan. 25, 1958).

A toroidal ceramic discharge-tube of 5 cm bore and about 30 cm mean diameter with 3 mm walls was operated at currents of up to 230 kA with rise times of about 10 μsec, in deuterium at from 40 to 400 μ Hg pressure, with toroidal magnetic fields of up to 5000 gauss. Magnetic probe pressure measurements indicate average temperatures greater than 1.25×10^6 °C. Neutron yields of up to 10^6 neutrons per discharge occur in bursts of ~ 2 μsec duration superimposed on a more continuous yield which extends through the discharge current zero for times of up to 30 μsec. Neutron yields as a function of B_Z, initial pressure and nitrogen contamination are reported. A temperature of 600 eV would be consistent with a thermonuclear origin of the observed neutron yield. R.S.Pease

539.172

NUCLEAR REACTIONS DUE TO COSMIC RAYS. See also under "Cosmic rays". Decimal classification 537.591.8

ATOMS

539.18

780. REMARKS ON CERTAIN SPECTRAL RELATIVISTIC CORRECTIONS CONCERNING SPATIALLY EXTENDED NUCLEI. T.T.Vescan and G.Ionită-Bârsan.
C.R. Acad. Sci. (Paris), Vol. 244, No. 19, 2358-61 (May 6, 1957). In French.

The introduction into Dirac's equation of the potential $V(r) = -e/r - eR/2r^2 + eR/2(r^2 - R^2)$ leads, with the usual value for the radius R of the proton, to a displacement of 1.7×10^{-3} cm^{-1} of the level $2^2S_{1/2}$ with respect to $2^2P_{1/2}$. L.Pincherle

539.18

781. ON THE MAGNETIC RESONANCE OF ATOMIC LEVELS OF MERCURY EXCITED BY ELECTRONIC BOMBARDMENT.
J.C.Perbay-Peyroula, J.Brossel and A.Kastler.
C.R. Acad. Sci. (Paris), Vol. 245, No. 8, 840-2 (Aug. 19, 1957).
In French.

The magnetic resonance technique was used to study eleven transitions in Hg. Lande g factors were measured, and an upper limit of 2×10^{-7} sec was placed upon the lifetime of the 6^3F_4 state. R.W.Nicholls

539.18

782. DISCUSSION OF SLATER PARAMETERS FOR ELEMENTS OF THE FIRST LONG PERIOD. D.A.Brown.
J. chem. Phys., Vol. 28, No. 1, 67-70 (Jan., 1958).

Slater–Condon parameters are calculated for elements of the first long period in terms of Slater functions. By comparison with the observed spectroscopic data it is found that the Slater rules predict reasonable values for the exponents of these functions, with certain important qualifications regarding the variation of the screening number with configuration. The exchange integral between the 3d and 4s functions is less satisfactory. By means of the derived results the reduction of Slater–Condon parameters within complexes is attributed in part to a polarization of the 3d functions so as to achieve near equality of Slater exponents with those of the ligands. A.

539.18

783. THE CALCULATION OF ATOMIC WAVE-FUNCTIONS AND OSCILLATOR STRENGTHS WITH AN ELECTRONIC COMPUTER.
L.A.Vaĭnshteĭn.
Optika i Spektrosk., Vol. 3, No. 4, 313-21 (1957). In Russian.

The use of semi-empirical methods for the calculation of the radial functions of atomic electrons is discussed. A new variation of the method is proposed in which the atom-core field is expressed as linearly deformed wave-functions based on Fok's equation. The method is used for the calculation on an electronic computer of both atomic wave-functions and oscillator strengths of Na, K, Cs, Mg, Hg, Cd, He and O. It is shown that for the field calculation, simple analytical functions can be used. In some cases the computed oscillator strengths differ from the experimental values; possible reasons for these discrepancies are discussed. L.Bovey

539.18

784. RADIATIVE CORRECTIONS TO THE GROUND-STATE ENERGY OF THE HELIUM ATOM. P.K.Kabir and E.E.Salpeter.
Phys. Rev., Vol. 108, No. 5, 1256-63 (Dec. 1, 1957).

The radiative corrections of relative order $Z^2\alpha^3$ (absolute order $Z^4\alpha^3$ ry), corresponding to the Lamb shift terms arising from the nuclear Coulomb potential, and some of the $Z\alpha^3$ corrections, arising from radiative interactions between the electrons, are calculated for the ground state energy of the helium atom. The $Z^2\alpha^3$ corrections are all calculated, but of the $Z\alpha^3$ corrections, which are expected to be much smaller, only those containing $\ln\alpha$ as a factor are retained — these may be estimated rather easily — and the rest are neglected, regarding unity as being small compared to $\ln\alpha$. The $Z^2\alpha^3$ corrections require the calculation of an "average excitation energy" similar to the one defined by Bethe for the hydrogen atom. It is found that virtual transitions to states (1s) × (continuous p)^{1}P are the most important, and these are calculated using the momentum matrix-elements obtained by Huang, who used a six-parameter Hylleraas wave-function for the ground state, and a product wave-function with Z = 2 for the s-electron and Z = 1 for the p-electron (full screening), for the excited states. Transitions to states other than (1s) (continuous p)^{1}P are also considered, and the value of the "average excitation energy" for helium is found to be 80.5 ± 10 ry, where the limits represent an estimate of the probable error of the result. The radiative correction to the ionization potential, which will be the difference of the corrections for the two-electron atom and the ion, is found to be -1.26 ± 0.2 cm^{-1}, where the error includes an estimation of the $Z\alpha^3$ terms which are not calculated. The corresponding radiative corrections are calculated, less accurately, also for Li^+, and the results generalized for helium-like ions of higher Z by an extrapolation formula. A.

539.18

785. WAVE FUNCTIONS FOR HELIUM AND SIMILAR ATOMIC SYSTEMS. A.L.Stewart.
Proc. Phys. Soc. A, Vol. 70, Pt 10, 756-9 (Oct., 1957).

Perturbation theory is used to calculate the energy (to the second order) and the diamagnetic susceptibility (to the first order) of He-like atoms, using as first-order perturbation to the wave-function a linear combination of hydrogen-like orbitals. The energy for the ground state is the best that has yet been obtained using one-electron orbitals; the calculated diamagnetic susceptibility is reasonable. J.Hawgood

539.18

786. PROPERTIES OF THE HELIUM ATOM.
A.Dalgarno and N.Lynn.
Proc. Phys. Soc. A, Vol. 70, Pt 11, 802-8 (Nov., 1957).

The available theoretical values of the oscillator strengths of dipole transitions from the ground state of helium are modified so that they satisfy four different sum rules. They are then employed to evaluate the refractive index, the Verdet constant, the diamagnetic susceptibility, the Lamb shift, the average energy loss for fast particle impact and the van der Waals interaction between two helium atoms, good agreement being obtained with experimental data where comparison is possible. A.

539.18

787. HYPERFINE STRUCTURES OF THE RESONANCE LINES OF INDIUM 115. D.A.Jackson.
Proc. Roy. Soc. A, Vol. 241, 283-98 (Aug. 20, 1957).

The hyperfine structures of the two visible resonance lines of the arc spectrum of indium 115 were measured in the absorption of a multiple atomic beam of high collimation by means of a double Fabry–Perot interferometer; the combined instrumental and Doppler width of the absorption lines was less than 5 mK (0.005 cm^{-1}). By taking the necessary precautions to avoid systematic errors and by measuring a large number of different interferograms to reduce the random error it was possible to measure the h.f.s. of the lines 4101 and 4511 A with an accuracy sufficient to allow the intervals of the terms $5\ ^2P_{3/2}$, $5\ ^2P_{1/2}$ and $6\ S_{1/2}$ to be determined with a probable error of 0.07 mK. The ratios of the three h.f.s. intervals of the term $5\ ^2P_{3/2}$ are in agreement, within the limits of the probable error, with those required on the assumption that the h.f.s. is due to nuclear magnetic dipole and electric quadrupole moments; the value found for the dipole coupling factor, A, is 8.083 ± 0.01 mK and for the quadrupole coupling factor, B, is 15.10 ± 0.1 mK. A comparison is made between the values of the h.f.s. intervals found in this work and those found by microwave measurements, since one of the principal aims of this research is to test the agreement between the results found by optical spectroscopic methods and by microwave methods. A.

539.18

788. ON THE PROBLEM OF QUASICLASSICAL SINGLE-ELECTRON FUNCTIONS. N.I.Zhirnov.
Zh. éksper. teor. Fiz., Vol. 32, No. 5, 1252-4 (1957). In Russian.

Wave-functions for bound states in complex atoms are calculated, i.e. for electrons in a Fermi–Thomas potential. Results for X-ray intensities obtained using these are in good agreement with experiment. G.E.Brown

539.18

789. LEVEL DISPLACEMENTS IN π-MESIC ATOMS.
S.M.Bilen'kiĭ.
Zh. éksper. teor. Fiz., Vol. 32, No. 3, 624 (1957). In Russian.

A complex potential is assumed for electromagnetic interaction with the nucleus. Using perturbation theory methods the average value for the interaction potential on the orbit of a π-meson is calculated for light nuclei. The potential varies irregularly with A. G.Martelli

539.18

790. INELASTIC HEAVY PARTICLE COLLISIONS INVOLVING THE CROSSING OF POTENTIAL ENERGY CURVES. V. CHARGE TRANSFER FROM NEUTRAL ATOMS TO DOUBLY AND TRIPLY CHARGED IONS. T.J.M.Boyd and B.L.Moiseiwitsch.
Proc. Phys. Soc. A, Vol. 70, Pt 11, 809-14 (Nov., 1957).

For Pt IV see Abstr. 2369 (1957). The Landau–Zener formula for the transition probability arising from the pseudo-crossing of potential energy curves is used to investigate charge transfer processes of the type $A + B^{3+} \rightarrow A^+ + B^{2+}$ involving neutral helium atoms and triply charged ions of Be, Li, Al and Mg. In addition, a method based on the Landau–Zener formula involving one experimentally determined parameter is used to calculate cross-sections for processes of the type $A + B^{2+} \rightarrow A^+ + B^+$. Good agreement is found with the cross-sections obtained in the laboratory by Hasted and Smith for N^{2+} ions in He and Ne, and for A^{2+} ions in Ne. A.

539.18

791. THE APPLICATION OF VARIATIONAL METHODS TO ATOMIC SCATTERING PROBLEMS. V. THE ZERO ENERGY LIMIT OF THE CROSS-SECTION FOR ELASTIC SCATTERING OF ELECTRONS BY HYDROGEN ATOMS. M.J.Seaton.
Proc. Roy. Soc. A, Vol. 241, 522-30 (Sept. 10, 1957).

Calculations are made using the central-field, exchange and exchange-polarization approximations. In agreement with previous work it is found that the wave-functions are profoundly modified by inclusion of exchange. The exchange radial equations are solved by numerical integration and by variational methods; consideration of the form of the equations for moderately large radial distances suggests an improved two-parameter trial function which is found to give satisfactory results. Polarization, i.e. the inclusion of the interelectronic distance r_{12} in the trial function, is much more important for the symmetric than for the anti-symmetric case. A symmetric exchange-polarization trial function is obtained which appears more satisfactory than those previously employed. It may be hoped that the final result for the zero-energy elastic scattering cross-section, $Q(0) = 5.76 \times 10^{-15}$ cm^2, is correct to within about 15%. A.

MOLECULES

539.19 : 535.343

792. MOLECULAR SYMMETRY AND INFRARED SPECTRAL ACTIVITY. C.Duculot.
Cahiers de Phys., Vol. 11, 159-68 (April, 1957). In French.

The study of infrared spectral transitions using a method based on the calculation of the coordinates of symmetry of a system is theoretically discussed. G.I.W.Llewelyn

539.19 : 534.343

793. INFRARED SPECTRA AND VIBRATIONAL ASSIGNMENT OF MONOMERIC FORMIC ACID. R.C.Millikan and K.S.Pitzer.
J. chem. Phys., Vol. 27, No. 6, 1305-8 (Dec., 1957).

The infrared spectra of monomeric HCOOH, HCOOD, DCOOH, and DCOOD were studied in the gaseous phase with emphasis on the 800 to 450 cm^{-1} region. New absorption bands were found for HCOOD at 541 and 512 cm^{-1}, and for DCOOD at 538 and 489 cm^{-1}. These bands are attributed to the a' OCO bending and to the a'' O—D torsion motions, respectively. In HCOOH and DCOOH the bands arising from the corresponding vibrations apparently coincide at approximately 630 cm^{-1}. An assignment of fundamentals for the four isotopic species is derived. Excellent agreement is obtained with the Teller—Redlich product rule. Also the calculated entropy agrees with the experimental value from the third law of thermodynamics. A.

539.19

794. THE CONTINUITY CONDITIONS IN A METALLIC MODEL OF A MOLECULE. T.K.Rebane.
Vestnik Leningrad. Univ., Ser. Fiz. Khim., 1957, No. 10, 11-20. In Russian, with summary in English.

A theoretical paper devoted to a discussion of the continuity conditions to be satisfied by unidimensional wave-functions and their derivatives at the lattice junctions. For simplicity only a plane network is considered (a) in the absence of magnetic field, (b) with uniform magnetic field. Discussions of case (a) occur in the literature but this would appear to be a first discussion of (b). C.R.S.Manders

539.19

795. MEASUREMENT OF THE SECOND MOMENT OF PARAMAGNETIC RESONANCE LINES WITH STRONG EXCHANGE NARROWING. J.Hervé.
C.R. Acad. Sci. (Paris), Vol. 245, No. 6, 653-6 (Aug. 5, 1957). In French.

Applies the proposed method (Abstr. 7269/1957) for direct determination of the second moment of absorption lines in paramagnetic resonance by observing the harmonic component of the signal obtained by modulating through the line-width with reversal of alternate half-cycle components. With sugar charcoal the asymptotic second moment, 10 gauss^2, is soon reached on increasing the modulation to 30 gauss. For the exchange-narrowed diphenyl picryl hydrazyl the true second moment is not reached with 70 gauss modulation since the second moment contribution from the wings of the line is very large. D.H.Whiffen

539.19

796. MOLECULAR AND CRYSTAL STRUCTURE OF B_6H_{10}. F.L.Hirshfeld, K.Eriks, R.E.Dickerson, E.L.Lippert, Jr and W.N.Lipscomb.
J. chem. Phys., Vol. 26, No. 1, 56-61 (Jan., 1958).

The approximately pentagonal pyramidal arrangement for boron atoms in B_6H_{10} is shown to be attached to a hydrogen arrangement resulting in C_S-m molecular symmetry. There are four bridge hydrogens and no BH_2 groups in the molecule. The boron framework is bonded, to a very rough approximation, by two electron-pair bonds and two three-centre bonds. The electron-pair bond perpendicular to the molecular symmetry plane is usually short (1.60 A). Comparison with other boron hydrides leads to some tentative conclusions about factors governing the relative stabilities of these compounds. A.

539.19 : 535.343

797. INFRARED INTENSITIES AND BOND MOMENTS IN $CO^{12}O^{18}$. D.F.Eggers, Jr and C.B.Arends.
J. chem. Phys., Vol. 27, No. 6, 1405-10 (Dec., 1957).

By using isotpically enriched samples, the three fundamentals and one overtone of $CO^{16}O^{18}$ were located in the gas phase. Positions disagree with predictions of a simplified theory by somewhat more than experimental error, especially for the Fermi-resonant pair ν_1 and $2\nu_2^0$. Intensities were also measured on the Fermi-resonant pair, and the bond moment derivative thus calculated, 5.79×10^{-10} e.s.u., is in excellent agreement with that determined from the ν_3 vibration of the normal isotopic molecule. This result lends support to the simple bond-moment hypothesis for stretching vibrations. Intensities were also measured on the solid phases of $CO^{16}O^{18}$ and of N_2O; the results are in poor agreement with measurements on the gas phase, though the frequencies are only slightly shifted. A.

539.19 : 539.14

DISTORTION OF MOLECULAR BEAM RESONANCES BY EXTRANEOUS ELECTROMAGNETIC FIELDS. See Abstr. 719

539.19

798. EXCITATION OF MOLECULAR VIBRATION BY COLLISION. M.Salkoff and E.Bauer.
New York Univ. (Inst. Math. Sci.), Res. Rep. No. CX-31,58 pp. (July, 1957).

The cross-section for excitation of the first vibrational level during the collision of two H_2 molecules in the ground state is calculated by a perturbation method. The total cross-section is obtained in the range 0.5 to 2.0 eV; the perturbation scheme breaks down at energies > 5 eV. The cross-section is very sensitive to the intermolecular potential. G.Allen

539.19

799. ENERGY OF A MOLECULE OF THE SYMMETRICAL-TOP TYPE IN AN EXTERNAL ELECTRIC FIELD. G.M.Genkin.
Optika i Spektrosk., Vol. 2, No. 4, 530-4 (1957). In Russian.

This theoretical paper deals with the calculation of the energy of a non-linear molecule of the symmetrical-top type. This symmetrical-top molecule possesses a constant dipole moment, which is assumed to lie along the axis of symmetry of the molecule, and is acted on by an external constant electric field. Solution of a matrix Schrödinger equation yields an expression for the energy which, for weak fields, is identical with that obtained from perturbation theory. S.Chomet

SOLID-STATE PHYSICS

539.2

800. LATTICE ENERGIES OF IONIC CUBIC CRYSTALS. C.E.Weir.
Phys. Rev., Vol. 108, No. 1, 19-21 (Oct. 1, 1957).

By means of a proposed hypothetical cycle the lattice energies of binary alkaline earth-group VI ionic crystals are calculated from those of the alkali halides with reasonably good agreement. A.

539.2

801. ENERGY BAND STRUCTURE IN SILICON CRYSTALS BY THE ORTHOGONALIZED PLANE-WAVE METHOD. F.Bassani.
Phys. Rev., Vol. 108, No. 2, 263-4 (Oct. 15, 1957).

The values of the energies at the point $K = 2\pi a^{-1}(1,0,0)$ are calculated in Si by the orthogonalized plane-wave method. The curves

of energy v. K are drawn in the [100] direction. The results are in agreement with the fact that Si is an insulator. They also indicate that the minimum of the lowest conduction band lies near the surface of the zone. A.

539.2

802. ENERGY BAND STRUCTURE OF LITHIUM BY A MODIFIED PLANE WAVE METHOD. E.Brown and J.A.Krumhansl.
Phys. Rev., Vol. 109, No. 1, 30-5 (Jan. 1, 1958).

The one-electron Schrödinger equation is discussed for a periodic lattice. A variational procedure is applied to a set of trial functions consisting mainly of plane waves of low wave-number. Rapid convergence is obtained by use of one or more auxiliary functions whose Fourier coefficients for high wave-numbers approximate those of the correct eigenfunctions. The orthogonalized plane wave (O.P.W.) method is a special case of this general method and the equivalence is shown. When applied to lithium the method gives a band structure in substantial agreement with that of cellular methods. A.

539.2

803. ENERGY-BAND STRUCTURE OF A HYPOTHETICAL CARBON METAL. R.C.Casella.
Phys. Rev., Vol. 109, No. 1, 54-61 (Jan. 1, 1958).

Energy bands are derived for a hypothetical crystal composed of carbon atoms arrayed in a single face-centred-cubic lattice by the method of orthogonalized plane waves (O.P.W.). The bands are compared with those of diamond which have been obtained by Herman. It is shown that the hypothetical crystal is an almost perfect metal. A potential for atomic carbon in the ^3P ground-state is computed within the framework of Slater's free-electron-exchange approximation. An analytical approximation to this potential is provided. Results of a general symmetry analysis, appropriate for application of the O.P.W. method to any f.c.c. lattice, are given. The cohesive energy of the metallic crystal relative to that of diamond is discussed within the approximation employed. A.

539.2

804. BAND STRUCTURE OF GRAPHITE.
J.C.Slonczewski and P.R.Weiss.
Phys. Rev., Vol. 109, No. 2, 272-9 (Jan. 15, 1958).

Tight-binding calculations, using a two-dimensional model of the graphite lattice, lead to a point of contact of valence and conduction bands at the corner of the reduced Brillouin zone. A perturbation calculation which starts with wave-functions of the two-dimensional lattice and is applied to the three-dimensional lattice is described. Some general features of the structure of the π bands in the neighbourhood of the zone edge are obtained and are expressed in terms of appropriate parameters. A.

539.2

805. EXCITON MODELS IN THE ALKALI HALIDES.
D.L.Dexter.
Phys. Rev., Vol. 108, No. 3, 707-12 (Nov. 1, 1957).

The common models for excitons in the alkali halides are criticized as to their goodness as zero-order models. Some new calculations on energies, oscillator strengths, and charge distributions are made with the models as they are commonly used. It is shown that the customary use of an L.C.A.O. (linear combination of atomic orbitals) method with the electron-transfer model gives qualitatively incorrect results, particularly for the wave-functions and charge distributions, results which are not even internally consistent with the model. It is argued that the other model, an excitation model, gives at least semiquantitatively correct results, and is a satisfactory zero-order approximation. Finally, it is shown that in the alkali halides the L.C.A.O. method must inevitably be an inconvenient one for finding accurate charge distributions and wave-functions for localized centres. A.

539.2

806. EFFECT OF DEFECTS OF SPIN INTERACTIONS IN A SIMPLE CUBIC LATTICE. A.Isihara.
Phys. Rev., Vol. 108, No. 3, 619-29 (Nov. 1, 1957).

Effects of lattice defects such as foreign atoms or holes on spin–spin interactions in a simple cubic lattice are calculated by using the so-called spherical model developed by Montroll, Berlin and Kac, and others. In the case when the concentration of defects is low and the distance between any pair of defects is large, the exact positions of the defects are not important and the excess free energy and other thermodynamical functions are determined by the concentration and the nature of defects. The Langevin–Curie law of magnetic suceptibility is modified by the presence of defects. The ferromagnetic Curie point is also affected by the presence of defects and is a linear function of defect concentration for low concentrations. When defect atoms have stronger exchange interactions with their nearest neighbours than that of the rest of the atoms in the lattice, the Curie point is raised and the specific heat v. temperature curve is enhanced. The reverse is true when defect atoms have weaker exchange interactions with their nearest neighbours. A.

539.2

807. COLOUR CENTRES IN IRRADIATED DIAMONDS. I.
C.A.Coulson and M.J.Kearsley.
Proc. Roy Soc. A, Vol, 241, 433-54 (Sept. 10, 1957).

A theoretical calculation of the energy levels, and hence absorption spectrum, of an isolated vacancy in an otherwise perfect diamond lattice is made. The concept of a defect molecule is introduced. This enables familiar molecular orbital theory to be applied in calculating the electronic structure of the defect. The quantitative results suggest that the observed band at 2.0 eV causing irradiated diamonds to appear blue, is due to spin and orbitally allowed electronic transitions of symmetry $^1E \rightarrow {}^1T_2$ in the neighbourhood of isolated neutral vacancies. A.

539.2 : 530.145

808. SPACE-GROUP OPERATIONS AND TIME-REVERSAL FOR A DIRAC ELECTRON IN A CRYSTAL FIELD. D.F.Johnston.
Proc. Roy. Soc. A, Vol. 243, No. 1235, 546-54 (1958).

It is shown how the basic formalism of the theory of spin–orbit coupling in the band theory of crystals can be deduced at once from the Dirac equation without the usual ambiguities over improper rotations associated with the formalism based on the Pauli–Schrödinger equation. It is also shown that the original proofs of the time-reversal theorems given by Wigher are unnecessarily complicated. A.

539.2

809. ON THE POSSIBILITY OF OBSERVING THE CHANGE IN THE CHEMICAL POTENTIAL OF ELECTRONS IN A METAL IN A MAGNETIC FIELD.
M.I.Kaganov, I.M.Lifshits and K.D.Sinel'nikov.
Zh. éksper. teor. Fiz., Vol. 32, No. 3, 605-7 (1957). In Russian.

Two possible methods are suggested. One involves the measurement of the contact p.d. between two specimens of the same metal, one being in a strong magnetic field. In the other method, the change in chemical potential can, in principle, be deduced from the dependence of the electron emission current on magnetic field.
J.B.Arthur

STRUCTURE OF SOLIDS

539.213.26

810. AMORPHOUS STRUCTURE FROM POLISHING AND GRINDING PROCESSES. H.Richter.
Z. angew. Phys., Vol. 8, No. 12, 585-92 (Dec., 1956). In German.

Amorphous layers are produced on Sn and Pb and their alloys by polishing, by etching, by melting followed by quick cooling, and by grinding. Electron diffraction examination shows that these layers are not identical with the glassy Beilby layer but are more closely related to the oxides and hydroxides of the metals concerned.
J.Thewlis

539.217

811. DIFFUSION OF OXYGEN IN SILICON.
R.A.Logan and A.J.Peters.
J. appl. Phys., Vol. 28, No. 7, 819-20 (July, 1957).

Oxygen, diffused into silicon by heating at 1300°C, was revealed by Dash's etching technique (Abstr. 2817/1957). Oxygen decreased the growth rate of etch pits. On re-heating a crystal with diffused oxygen at 450°C, a donor layer formed. The diffusion constant at 1300°C is 1.8×10^{-10} cm^2. sec^{-1}. J.Franks

539.219 : 536.63

812. CALORIMETRIC STUDY OF Cu_3Au AT HIGH TEMPERATURES. M.Hirabayashi, S.Nagasaki and H.Kōno.
J. appl. Phys., Vol. 28, No. 9, 1070-1 (Sept., 1957).

In view of results reported by Kuczinski, Doyama and Fine (Abstr. 5438/1956) the specific heat and thermal expansion of this alloy were remeasured. A latent heat was observed at the critical

point, 388°C, but no anomalous peaks as reported by Kuczinski et al. Several measurements were made of the specific heat of the alloy quenched from various temperatures into ice water. Results obtained are in agreement with those of other workers.

E.W.Kellermann

539.23 : 535.39

813. STUDY OF THE STRUCTURE OF THIN TRANSPARENT LAYERS BY INVESTIGATING THEIR OPTICAL PROPERTIES. P.Bousquet.
Ann. Phys. (Paris), Ser. 13, Vol. 2, No. 3-4, 163-213 (March-April, 1957). In French.

The first part is theoretical and concerns the effect of heterogeneity, anisotropy and discontinuous structure of layers on their optical properties. The layers are considered to be absorbing, anisotropic and dichroic; for the special case of transparent, homogeneous and isotropic layers the general formulae for the complex reflection and transmission coefficients lead to the classical formulae, which alone have been used by previous workers. The apparatus for measuring reflection and transmission coefficients for all angles of incidence is described in the second part. Photometric measurements are accurate to 3×10^{-3} and angle measurements to 2 min. In the third part results are given on fluorspar and cryolite prepared by evaporation. Spectrophotometric measurements at normal incidence show that the layers are inhomogeneous (i.e. refractive index not constant); measurements at oblique angles indicate the presence of zones of transition within the layers; and measurements in the total reflection zone suggest that the layers are anisotropic.

B.T.M.Willis

539.23

814. SOME PROPERTIES OF THIN METALLIC LAYERS. I. PRELIMINARY CONSIDERATIONS. M.Perrot.
J. Phys. Radium, Vol. 18, No. 4, 280-1 (April, 1957). In French.

The necessity of carrying out optical or electrical measurements in vacuo is stressed. B.T.M.Willis

539.23

815. SOME PROPERTIES OF THIN METALLIC LAYERS. II. STUDY OF THIN METALLIC LAYERS OF GALLIUM. J.Tortosa.
J. Phys. Radium, Vol. 18, No. 4, 281-2 (April, 1957). In French.

For Pt I, see preceding abstract. A new method of measuring the reflection coefficient R under vacuum is described. R was measured as a function of thickness for gallium layers up to 20 mμ thick, and for the mercury wavelengths λ = 4358, 5461, 5780 A.

B.T.M.Willis

539.234 : 539.371 : 539.4.016.3

816. STRESS ANNEALING IN VACUUM DEPOSITED COPPER FILMS. H.S.Story and R.W.Hoffman.
Proc. Phys. Soc. B, Vol. 70, Pt 10, 950-60 (Oct., 1957).

An apparatus has been built for the measurement of mechanical stress in vacuum-deposited films. A study of the stress changes during pulse annealing has been made with copper films deposited at several substrate temperatures between −150°C and +75°C. The annealing spectrum shows a prominent peak centred near room temperature which matches a resistance annealing peak in similar films and also in cold-worked copper. The fall of tensile stress in this region suggests a vacancy mechanism. The theory of Murbach and Wilman for the behaviour of initial stress with temperature is not supported by these results. A.

539.26

817. TESTS ON THE ABSOLUTE MEASUREMENT OF SPECIFIC SURFACE BY X-RAY SCATTERING AT SMALL ANGLES. S.Durif.
J. Chim. phys., Vol. 54, No. 7-8, 633-6 (July-Aug., 1957). In French.

Porod's expression giving surface area in terms of the intensity variation in the "tail" of the low-angle scattering curve (Kolloid Zeitschrift, Vol. 124, 83, 1951; Vol. 25, 51, 1952) is applied to some carbon blacks. A.R.Stokes

ELASTICITY. STRENGTH. RHEOLOGY

539.32

818. THE VARIATION WITH TEMPERATURE OF THE DYNAMIC ELASTIC MODULI OF AN ORGANIC GLASS AT TWO FREQUENCIES. S.M.Crawford.
Proc. Phys. Soc. B, Vol. 70, Pt 11, 1045-8 (Nov., 1957).

Measurements were made of the dynamic shear modulus and velocity of longitudinal waves in an organic glass at frequencies of 4 Mc/s and 20 Mc/s. It is found that there is a relaxation in the real part of the shear modulus which occurs at a higher temperature at 20 Mc/s than at 4 Mc/s; at each of these temperatures, the relaxation time is of the same order as the period of the applied stress. The real part of the bulk modulus calculated from the results appears to be independent of frequency but shows a transition in the form of its behaviour with temperature. A.

539.374

819. PLASTICITY IN THE SCIENCE OF CONSTRUCTION. [Symposium su la plasticita nella scienza delle costruzioni].
Bologna: Nicola Zanichelli, 351 pp.

This volume (distributed in connection with Nuovo Cimento) contains the 21 papers presented at a meeting in Varenna in September, 1956, in honour of Arturo Danusso. The papers are in Italian, French, English or German, and are on problems of plasticity, duration of load, creep, buckling and collapse of structures, and the strength of steel and reinforced concrete.

539.374 : 548.5

820. PLASTIC DEFORMATION OF COPPER AND SILVER WHISKERS. S.S.Brenner.
J. appl. Phys., Vol. 28, No. 9, 1023-6 (Sept., 1957).

By rapidly reducing the stress after yielding, it was possible to study the plastic deformation of copper and silver whiskers. The whiskers exhibit extremely sharp yield points and extensive easy "glide" regions which are due to the propagation of Lüders bands. It is unlikely that the sharp yield points are caused by dislocation pinning. The propagation of the Lüders bands often becomes obstructed giving rise to repeated yielding in the plastic region. The nature of these obstructions and the mechanism of Lüders band propagation are not clear. A.

539.374 : 535.37 : 535.343

EFFECT OF PLASTIC DEFORMATION UPON THE OPTICAL PROPERTIES OF ALKALI HALIDES. See Abstr. 577

539.4.016.3 : 539.371 : 539.234

STRESS ANNEALING IN VACUUM DEPOSITED COPPER FILMS. See Abstr. 816

539.62

821. LUBRICATION BY LAMELLAR SOLIDS. R.F.Deacon and J.F.Goodman.
Proc. Roy. Soc. A, Vol. 243, No. 1235, 464-82 (1958).

An experimental study was made of the friction properties of graphite, molybdenum disulphide, boron nitride and talc. The formation of surface layers of the lamellar solids on platinum, and the friction of these layers at elevated temperatures in air were examined. A.

539.89 : 548.736.4

822. X-RAY INVESTIGATION OF THE EFFECT OF UNILATERAL PRESSURE ON THE STRUCTURE OF POLYCRYSTALLINE BARIUM TITANATE. I.G.Ismailzade.
Dokl. Akad. Nauk SSSR, Vol. 115, No. 3, 479-82 (1957). In Russian.

At room temperatures a unilateral pressure of 600-1000 kg/cm² does not alter the volume of the unit $BaTiO_3$ cell, but increases the tetragonal character of the lattice c/a. The latter fact results in a shift of the Curie point to higher temperatures because it renders transition to a cubic lattice more difficult, i.e. requiring higher temperatures. Electrical Research Association

539.89 : 537.323 : 539.215 : 537.312.9

CONTACT EFFECTS RESULTING FROM COMPRESSION AND FLASH SINTERING IN GRAPHITE POWDERS. See Abstr. 623

PHYSICAL CHEMISTRY

PHASE EQUILIBRIUM. CHEMICAL REACTIONS

541.124 : 548.74

823. THE THERMAL DECOMPOSITION OF CUPRIC OXIDE IN VACUO. A.Goswami and Y.N.Trehan.
Proc. Phys. Soc. B, Vol. 70, Pt 10, 1005-8 (Oct., 1957).

541.124 : 537.312.5

THE REACTION OF OXYGEN WITH LEAD SELENIDE. See Abstr. 617

PHOTOCHEMISTRY. RADIATION CHEMISTRY

541.14

824. RATE CONSTANTS AT LOW CONCENTRATIONS. III. ATOMIC OXYGEN REACTIONS IN THE PHOTOLYSIS OF NITROGEN DIOXIDE AT 3660 A. H.W.Ford and N.Endow.
J. chem. Phys., Vol. 27, No. 5, 1156-60 (Nov., 1957).

For Pt II see Abstr. 7473 (1957). Quantum yields were obtained for the disappearance of nitrogen dioxide in photolysis at 3660 A and at concentrations below 4×10^{-7} mole per litre in nitrogen at one atmosphere pressure. The effects of small amounts of added nitric oxide and oxygen on the quantum yields were also observed. From these data and an assumed mechanism it was possible to calculate the rates of reaction of atomic oxygen with nitric oxide and nitrogen dioxide relative to the rate of reaction of atomic oxygen with molecular oxygen. These relative rates are converted to absolute rates using Benson and Axworthy's rate constant for the $O + O_2$ reaction. A.

541.14

825. RATE CONSTANTS AT LOW CONCENTRATIONS. IV. REACTIONS OF ATOMIC OXYGEN WITH VARIOUS HYDROCARBONS. H.W.Ford and N.Endow.
J. chem. Phys. Vol. 27, No. 6, 1277-9 (Dec., 1957).

Nitrogen dioxide was photolyzed at trace concentrations in a carrier gas at a pressure of 1 atmosphere. The concentration of atomic oxygen could be estimated by using rate constants previously obtained (see preceding abstract). An iterative method is used to calculate the concentration of atomic oxygen in the presence of trace amounts of hydrocarbons. Rate constants for the reactions of atomic oxygen with various hydrocarbons are reported, together with other closely related rate constants reported previously. A.

DISPERSIONS. COLLOIDS. ADSORPTION

541.182.3

826. CONCENTRATION CHANGES IN AN AEROSOL. J.F.Richardson and E.R.Wooding.
Chem. Engng Sci., Vol. 7, No. 1-2, 51-9 (1957).

Using optical methods, developed for measuring particle size and concentration in an aerosol, the concentration of particles was measured in a small sample of monodisperse aerosol as a function of vertical position and time. The results are used to verify the differential equation defining the concentration distribution in a system of particles subjected to the combined effects of Brownian motion and gravitation. Author

CHEMICAL ANALYSIS

545.82

827. ISOTOPE-CUM-SPECTRUM [METHOD OF] DETERMINATION OF HYDROGEN IN METALS. A.N.Zaĭdel' and A.A.Petrov.
Vestnik Leningrad. Univ.,Ser. Fiz. Khim., 1957, No. 10, 40-51.
In Russian,with summary in English.

An outgassed quartz tube contains a specimen of metal under test which contains occluded hydrogen. The tube containing the specimen is evacuated and filled with deuterium at known pressure and temperature. The tube with specimen is now detached and heated until hydrogen contained in the metal and deuterium surrounding it achieve an equilibrium state. For Ti, Zr, Armco iron, carbon steel, Cr—Ni steel, chrome—nickel temperatures can be up to 1100°C and times of heating 15-60 minutes. The gas surrounding the metal specimen is drawn off and submitted to spectral analysis. Measurement of the intensity ratio of the components of the H_α and H_β lines enables the hydrogen content to be worked out from relations derived in the paper. An accuracy of 4-8% is claimed with the possibility of easily detecting 0.5 cm^3 per 100 g of metal. C.R.S.Manders

545.827

828. BERYLLIUM-HAZARD DETECTION USING POLONIUM 210 ALPHAS. R.Gold.
Nucleonics, Vol. 15, No. 11, 114, 117, 118 (Nov., 1957).

Beryllium in air-borne dust collected on filter papers was estimated by bombarding the papers with alpha-particles and detecting the 4.4 MeV γ-ray from the $Be^9(\alpha,n\gamma)C^{12}$ reaction. Each estimation took 5-10 minutes. R.D.Smith

CRYSTALLOGRAPHY

548.24

829. DEFORMATION TWINNING IN THE DIAMOND STRUCTURE. R.Bullough.
Proc. Roy. Soc. A, Vol. 241, 568-77 (Sept. 10, 1957).

The theory of surface dislocations is used to calculate the most likely deformation twinning plane in the diamond structure. The surface dislocation representing the twin boundary is assumed to correspond to one parallel array of like, glissile dislocations; that is a "simple glissile surface dislocation". The treatment indicates that, in the diamond structure, deformation twinning of the first kind ought to occur on the {123} planes. A.

548.55

830. PREPARATION OF THIN SINGLE CRYSTALS OF BARIUM TITANATE. J.T.Last.
Rev. sci. Instrum., Vol. 28, No. 9, 720-1 (Sept., 1957).

Single-crystal samples of $BaTiO_3$, 1.5 μ thick, 1×2 mm^2 in area, were prepared by grinding to 100 μ and then etching in phosphoric acid at 130°C at a rate of 1 μ/min. The crystals were held in Teflon-silicone tape. J.Franks

X-RAY CRYSTALLOGRAPHY

548.73/.74

X-RAY AND ELECTRON INVESTIGATION OF MATERIALS. See also under "Structure of solids". Decimal classification 539.26/.27

548.734.3

831. COMPARISON OF WAVELENGTHS FOR X-RAY DIFFRACTION. J.C.M.Brentano.
J. appl. Phys., Vol. 28, No. 7, 822-3 (July, 1957).

See Abstr. 1750 (1957). The author considers that the peak/background ratio of an X-ray line is too strongly dependent on experimental conditions to make it a good criterion of the suitability of the line for powder diffractometry. A.R.Stokes

548.736.3 : 539.19

832. CRYSTAL AND MOLECULAR STRUCTURE OF DIBORON TETRAFLUORIDE, B_2F_4. L.Trefonas and W.N.Lipscomb.
J. chem. Phys., Vol. 28, No. 1, 54-5 (Jan., 1958).

X-ray diffraction study of a single crystal of B_2F_4 indicates a planar, centrosymmetric molecule with $B-B = 1.67 \pm 0.04_5$ A, $B-F = 1.32 \pm 0.03_5$ A and angle $F-B-F = 120^0$. There are two molecules in a monoclinic unit cell of symmetry $P2_1/n$ and parameters of $a = 5.49$, $b = 6.53$, $c = 4.83$, and $\beta = 102.5^0$. A.

548.736.4 : 539.89

X-RAY INVESTIGATION OF THE EFFECT OF UNILATERAL PRESSURE ON THE STRUCTURE OF POLYCRYSTALLINE BARIUM TITANATE. See Abstr. 822

GEOPHYSICS

550.34 : 534.2

THE CAUSES OF THE ABSORPTION OF ELASTIC WAVES. See Abstr. 542

ATMOSPHERE. METEOROLOGY

551.508.99

833. A PHOTOGRAPHIC APPARATUS WITH A WIDE FIELD FOR RECORDING THE WHOLE SKY. R.Cialdea.
Ann. Geofis., Vol. 9, No. 4, 451-67 (Oct., 1956). In Italian.

The apparatus consists of a convex mirror, forming a primary image which is recorded by a normal-angle camera. The aberrations of the system are calculated in terms of the mirror radius of curvature, the separation of the mirror and the camera objective, and the diameter of the entrance pupil. The best compromise between resolution and image brightness is found. R.W.Fish

551.510.535 : 538.566.3

834. ON THE DETERMINATION OF THE NUMBER OF COLLISIONS IN REGION F2 OF THE IONOSPHERE.
E.Argence and K.Rawer.
Nuovo Cimento Suppl. (Ser. 10), Vol. 4, No. 4, 1511-31 (1956).
In French.

The first part of the paper consists of a theoretical analysis of ionospheric absorption and of the influence of focusing at a curved ionospheric layer. The theory is then applied to some experimental results, considering separately the cases where the absorption is due to electron collisions with neutral molecules and with ions. The values of collisional frequency provisionally deduced appear to be considerably higher than those measured by rocket techniques. G.M.Brown

551.510.535 : 523.78

835. SOME OBSERVATIONS ON THE INFLUENCE OF A SOLAR ECLIPSE UPON THE IONOSPHERE. P.Dominici.
Nuovo Cimento Suppl. (Ser. 10), Vol. 4, No. 4, 1572-8 (1956).

For abstract see Abstr. 7045 (1956).

551.510.535

RADIO-WAVE PROPAGATION IN THE IONOSPHERE. See also under "Electromagnetic waves and oscillations". Decimal classification 538.566.3

551.510.535 : 538.566.3

ON THE ABSORPTION OF SHORT WAVES IN AN ISOTROPIC IONIZED LAYER. See Abstr. 666

551.521.14

836. THE ANGULAR DISTRIBUTION OF THE INTENSITY OF RADIATION REFLECTED BY NATURAL SURFACES.
K.Ya.Kondrat'ev and M.P.Manolova.
Vestnik Leningrad. Univ.,Ser. Fiz. Khim., 1957, No. 10, 52-8.
In Russian.

Measurements were made of solar and scattered radiation using a Yanishevskil pyranometer (angle of view 150^0) and a radiation thermoelement of Kozyrev design (angle of view 10^0), each mounted on a theodolite stand. Graphs are given for surfaces covered with snow, ice, barley, grass, etc. C.R.S.Manders

551.521.3

837. THE SCATTERING OF LIGHT IN A TWO-LAYER ATMOSPHERE. S.D.Gutshabash.
Vestnik Leningrad. Univ.,Ser. Mat. Mekh. Astron., 1957, No. 1, 158-64. In Russian.

The author considers the terrestrial atmosphere as consisting of two layers, a lower or aerosol layer and an upper or molecular layer. The intensities of the radiation at the boundary of the two layers and the transmission through the boundary are determined by a system of integral equations. Arising from the two-layer problem a new method is derived for calculating the radiation fields in a homogeneous medium. The paper is entirely theoretical. C.R.S.Manders

551.594.14 : 551.510.4

838. REDUCTION OF ATMOSPHERIC RADIOCARBON CONCENTRATION BY FOSSIL FUEL CARBON DIOXIDE AND THE MEAN LIFE OF CARBON DIOXIDE IN THE ATMOSPHERE.
G.J.Fergusson.
Proc. Roy. Soc. A, Vol. 243, No. 1235, 561-74 (1958).

It is generally accepted that the combustion of fossil fuels over the period 1860 to 1954 has produced an amount of carbon dioxide, containing no radiocarbon, that is equal to approximately 13% of the carbon dioxide in the atmosphere. The addition of this "old" carbon dioxide to the atmosphere has observably disturbed the steady-state distriburion of C^{14} in nature. In the present paper measurements are described of the C^{14} concentration in sets of wood samples from the northern and southern hemispheres, and these show that the C^{14} specific activity of atmospheric carbon dioxide has decreased by $2.03 \pm 0.15\%$ over the period 1860 to 1954, and that the present-day difference between the decrease in the northern and southern hemispheres is less than 0.50%. The response of various mathematical models of the carbon cycle in nature to addition of "old" carbon dioxide at an exponential rate has been considered. Using the above data in conjunction with these models it is deduced that: (1) The mean life of a carbon dioxide molecule in the atmosphere before it is absorbed into other reservoirs of carbon must be less than 7 yr, and is probably of the order of 2 yr. (2) The exchange time for mixing of the atmospheres of the two hemispheres (i.e. the mean life of a carbon dioxide molecule in the atmosphere of one hemisphere before transferrence to the other hemisphere) is less than 2 yr. A.

551.594.14 : 539.16.08

DETERMINATION OF RADON AND THORON IN AIR. See Abstr. 737

551.594.221

839. RADAR ECHOES FROM INTER-STROKE PROCESSES IN LIGHTNING. F.J.Hewitt.
Proc. Phys. Soc. B, Vol. 70, Pt 10, 961-79 (Oct., 1957).

Radar observations, on a wavelength of 50 cm, of inter-stroke lightning processes provide the following information on the nature of the charged column and the manner in which it is discharged: (a) Inter-stroke junction streamer activity is most intense and most prolonged in the lower regions, that is, at heights from 4-7 km. (b) Vertical development of the junction streamers may on occasion take place steadily to a height of about 10 km. The velocities are in good agreement with those derived by Malan and Schonland. The junction streamer activity is somewhat less intense in the upper

regions and tends to disappear while activity still persists in the lower regions. (c) The lower height limit of junction streamer activity remains at a more or less constant height throughout the flash. (d) The horizontal extent of the junction streamer activity in the lower regions is frequently of the order of 1.5-2 km. (e) The echoing properties of the junction streamers actually decrease during the latter part of the inter-stroke period and a further stroke does not occur until this decrease has taken place. (f) A stroke may take place from one or more regions in the charged column, without affecting appreciably the junction streamer process in another region which will nevertheless contribute to a later stroke in the same lightning discharge. Modifications to the tentative description of the inter-stroke processes given by Malan and Schonland are suggested which would explain these results. Some information has been gained on the nature and intensity of the noise radiated by lightning at 600 Mc/s. In particular it appears that at this frequency the noise is radiated from comparatively localized sources and may possibly be associated with the stepped and dart leader processes. A.

BIOLOGY

MEDICAL SCIENCE. HUMAN PHYSIOLOGY

612.843.4

840. RETINAL DISTRIBUTION OF ENTOPTIC STRAY LIGHT.
D.W.DeMott and R.M.Boynton.
J. Opt. Soc. Amer., Vol. 48, No. 1, 13-22 (Jan., 1958).

The primary purpose of this research was to determine, as accurately as possible, the illuminance distribution across the retina of the eye resulting from a small image formed at the back of the eye by nearly collimated light incident upon the cornea, with the illuminance distribution specified over a wide range, including angles close to the image proper. The measurements were taken by means of a photomultiplier tube located immediately behind a small aperture at the back of an excised steer eye. It is hoped that the results are generalizable to the living, human eye. Consequently, a variety of control studies were undertaken to support the possibility of such a generalization. These include investigations of post mortem changes (including studies with living eyes), use of "normal" v. Maxwellian view, wavelength, pupil diameter, and the shape of the retinal image. Although most of the work was done with excised steer eyes, some data were also taken with eyes from pigs and sheep. The final distribution is similar to, but not exactly the same as, that inferred from psychophysical investigations. A.

612.85

841. NEURAL VOLLEYS AND THE SIMILARITY BETWEEN SOME SENSATIONS PRODUCED BY TONES AND BY SKIN VIBRATIONS. C.v.Békésy.
J. Acoust. Soc. Amer., Vol. 29, No. 10, 1059-69 (Oct., 1957).

Some similarities and differences between skin sensations and hearing were investigated. The sensation of pitch on the skin has little similarity to the pitch sensation in hearing. The pitch sensation on the skin changes very much with changes in loudness, and there is a strong diplacusis between different parts of the skin. But the rotating skin sensations and rotating tones (Drehton) have many aspects in common. It was further found that the apparent size of the sensation on the skin and in the ear vary similarly as the stimulus changes. From a neurophysiological point of view, it seems to be important that it is possible to find a situation on the skin where two stimuli of different frequencies cancel each other completely. In this case, one sensation is inhibited by another, but the inhibiting sensation is felt no more. In order to be able to extrapolate from the skin to the cochlea, for several phenomena on the skin, the changes are plotted which occur when the vibrator is moved from an insensitive spot on the skin to a more sensitive one. A.

612.858.751

842. LOCALIZATION OF HIGH-FREQUENCY TONES.
W.E.Feddersen, T.T.Sandel, D.C.Teas and L.A.Jeffress.
J. Acoust. Soc. Amer., Vol. 29, No. 9, 988-91 (Sept., 1957).

An earlier study (Abstr. 10152/1955), attempted to correlate interaural intensity and time differences with the subject's localization response. The present paper is an extension of this. It includes physical measurements of interaural time differences and intensity differences, and attempts to relate these differences to the localization response at a variety of frequencies. The stimuli to be localized were provided through earphones, and the subject was required to match the position (in his head) of a noise and a tone. The noise to one ear was delayed, and the tone presented with no time or phase difference. The subject adjusted the interaural level of the tone until it and the noise appeared to be in the same place. The two were presented alternately by means of a gate having a 150 msec rise and decay time. Data from the localization judgments were then compared with the findings from the acoustical measurements of time and intensity. Several systematic trends were found, and compared with results of the previous study. A.

LIST OF JOURNALS

The following list supplements the List of Journals published with the June number of Volume 60 (1957) and the Supplement published with the Index to the same volume. Reprints of the List of Journals and of the Supplement can be obtained from The Institution of Electrical Engineers, Savoy Place, London, W.C.2, price 2s.0d. post free.

The addresses given are believed to be correct at the date of publication, but no responsibility can be accepted for errors.

Ann. N.Y. Acad. Sci.	Annals of the New York Academy of Sciences. 2 East 63rd Street, New York 21, N.Y.
Chem. Engng Sci.	Chemical Engineering Science. The Pergamon Press, 4 and 5 Fitzroy Square, London, W.1.
Elektrowärme	Elektrowärme. Beilage zu Österreichische Zeitschrift für Elektrizitätswirtschaft [O.Z.E.] Springer-Verlag, Mölkerbastei 5, Vienna I.
I.R.E. Nat. Convention Record	I.R.E. National Convention Record. Formerly Convention Record of the Institute of Radio Engineers [Convention Record Inst. Radio Engrs]. The Institute of Radio Engineers, 1 East 79th Street, New York 21, N.Y.
I.R.E. WESCON Convention Record	I.R.E. WESCON Convention Record. The Institute of Radio Engineers, 1 East 79th Street, New York 21, N.Y.
Vestnik Leningrad. Univ., Ser. Fiz. Khim.	Vestnik Leningradskogo Universiteta: Seriya Fiziki i Khimii. Leningrad University Press, Leningrad.
Vestnik Leningrad. Univ., Ser. Mat. Mekh. Astron.	Vestnik Leningradskogo Universiteta: Seriya Matematiki, Mekhaniki i Astronomii. Leningrad University Press, Leningrad.

NEW JOURNALS

Acta polytech. Scand.	Acta Polytechnica Scandinavica. Formerly Acta Polytechnica [Acta polytech.]. The Scandinavian Council for Applied Research. Publishing Office: P.O.Box 5073, Stockholm 5. The monographs in the new sub-series starting in 1958 will be numbered as follows: Electrical Engineering, El 1; Physics including Nucleonics, Ph. 1.
Atomkraftwerk	Das Atomkraftwerk. Beilage zu Österreichische Zeitschrift für Elektrizitätswirtschaft [O.Z.E.]. Springer-Verlag, Mölkerbastei 5, Vienna I. Vol. 1, No. 1 dated 1958.
Automatica si Electronica	Automatica si Electronica. Asociata Stiinţifica a Ingenerilor si Tehnicienilor din R.P.R. Publication address: Str. Ion Ghica 3, Bucarest. Vol. 1, No. 1 dated Jan.-Feb., 1957.
Österr. Ingen.-Z.	Österreichische Ingenieur-Zeitschrift. Continuation of Maschinenbau und Wärmewirtschaft [Maschinenbau u. Wärmewirtsch.], Zeitschrift des Österreichischen Ingenieur- und Architekten-Vereines [Z. Österr. Ingen.-Archit.-Vereines], and Österreichischen Bauschrift. Springer-Verlag, Mölkerbastei 5, Vienna I. Vol. 1, No. 1 dated Jan., 1958.

NOTES

Acta polytech.	Acta Polytechnica. Will be discontinued with the end of the year 1957 (Issue No. 240), and will be superseded by Acta Polytechnica Scandinavica [Acta polytech. Scand.]
Convention Record Inst. Radio Engrs	Convention Record of the Institute of Radio Engineers. Title changed to I.R.E. National Convention Record [I.R.E. Nat. Convention Record], starting with 1957.
Maschinenbau u. Wärmewirtsch. (M.u.W.)	Maschinenbau und Wärmewirtschaft. Incorporated in Österreichische Ingenieur-Zeitschrift [Österr. Ingen.-Z.] starting with the issue dated Jan., 1958.
Z. Österr. Ingen.-Archit.-Vereines	Zeitschrift des Österreichischen Ingenieur- und Architekten-Vereines. Incorporated in Österreichische Ingenieur-Zeitschrift [Österr. Ingen.-Z.] starting with the issue dated Jan., 1958.

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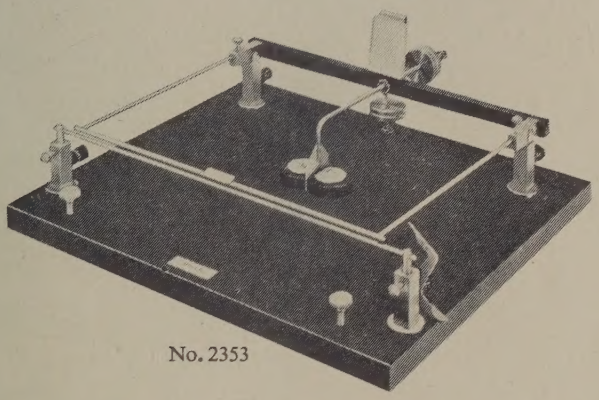

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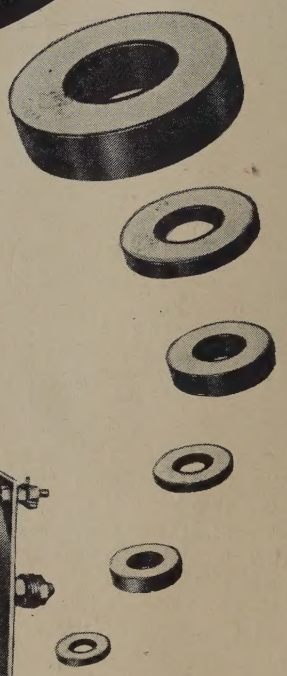

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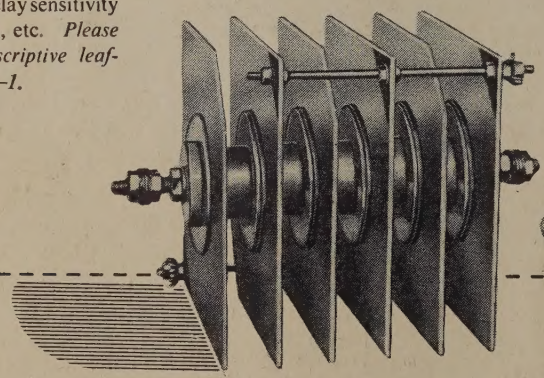

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